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THE UNIVERSITY OF ALBERTA

AN INVESTIGATION INTO THE GROWTH OF LANGUAGE  
CONCEPTS IN SCHOOL OF BELLEVUE INTERMEDIATE  
AND HIGH SCHOOL STUDENTS.

A DISSERTATION  
SUBMITTED TO THE GRADUATE FACULTY  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR  
THE DEGREE OF MASTER OF ARTS

DEPARTMENT OF EDUCATION

BY  
JAMES HENRY McLELLAN

BELLEVUE, ALBERTA

MAY, 1937.









# TABLE OF CONTENTS

	Page
INTRODUCTION	
LIST OF TABLES	
LIST OF FIGURES	
Chapter	
1. THE PROBLEM	1
11. APPROACH TO THE PROBLEM	2
Construction of the tests	
The tests	
Administering the tests	
Scoring	
111. SUMMARY OF DATA	18A
Class scores	
1V. ANALYSIS OF DATA	29
Correlations	
The knowledge scores	
The error scores	
The knowledge error ratio	
V. A MORE DETAILED QUALITATIVE ANALYSIS	47
Correct usage of words	
Definitions	
Recognition of correct usage, correct	
selection of synonyms and a measure	
of connotation	
VI. ESTIMATION OF MATURITY	53
VII. WORD ASSOCIATIONS	63
VIII. CRITICISMS, INTERPRETATIONS AND	
CONCLUSIONS	66



## INTRODUCTION

This field of investigation was suggested to me by Dr. H. E. Smith of the University of Alberta during a consultation I had with him in August, 1935, regarding a suitable subject for a thesis. Dr. Smith proposed that a longitudinal study be made from Grade VI to Grade XII, inclusive, for the purpose of estimating the increasing richness of language concepts during this period. As a method, he suggested that a set of key words be selected from some subject in which the investigator might be particularly interested, these words to serve as a basis for the investigation. Owing to the fact that my teaching has been confined chiefly to the Science subjects I made a selection from words used in General Science.

Throughout the investigation, Dr. M. E. Lazerte and Dr. H. E. Smith gave valuable suggestions and assisted materially by submitting one of the tests to a class of senior students at the university. I am also indebted to the teachers of the Bellevue school staff for their co-operation in giving the tests and to Miss E. Chiarovano for assistance in scoring and tabulating results. Mr. M. D. McLachern who was carrying out a parallel investigation with History words was an invaluable associate and has kindly permitted me to make use of the data he collected in order that I might compare my results with his and so have some check on the reliability of the tests.



# LIST OF TABLES

	Page
I. A Table of Correlations	29
II. Growth of Knowledge by Grades	30
III. Growth of Knowledge by Chronological Age	30
IV. Growth of Knowledge by Mental Age Groups	30
IVA. Showing Scores Made by Grades IV and V on Five of the Test Words.	34
IVB. Showing Probable Range of Actual Knowledge	35
V. Decrease of Error by Grades	37
VI. Decrease of Error by Chronological Age	37
VII. Decrease of Error by Mental Age Groups	38
VIII. Ratio of Mean Knowledge scores to Mean Error scores by Grades	42
IX. Ratio of Mean Knowledge Scores to Mean Error Scores by Chronological Age	42
X. Ratio of Mean Knowledge Scores to Mean Error Scores by Mental Age	43
XI. Percentage of Students in each Grade Who Were Able to Use the Words Correctly in Sentences	47
XII. Percentage of Students in Each Grade Who Gave Correct Definitions and Percentage of Correct Definitions Which Were Good, Fair and Weak	48
XIII. Percentage of Students in Each Grade Who Could Recognize Correct Usage of the Words	51
XIV. Selection of Synonyms	51
XV. A Measure of Connotation	51
XVI. A Comparison of Scores on the Word Principle	54
XVII. Knowledge Scores of Grades as Per Cents of the University Knowledge Score for the Word Principle	54



## LIST OF FIGURES

Figure	Page
1. Growth of Knowledge by Grades	31
2. Growth of Knowledge by Chronological Age	32
3. Growth of Knowledge by Mental Age	33
4. Showing Probable Range of Actual Knowledge	36
4b. Decrease of Error Scores by Grades	38
5. Decrease of Error by Chronological Age	39
6. Decrease of Error by Mental Age	40
7. Ratio of Mean Knowledge Scores to Mean Error Scores for Each Grade	43
8. Ratio of Mean Knowledge Scores to Mean Error Scores by Chronological Age	44
9. Ratio of Mean Knowledge Scores to Mean Error Scores by Mental Age	45
10. Percentage of Students in Each Grade Who Were Able to Use the Words Correctly in Sentences	47
11. Percentage of Students in Each Grade Who Gave Correct Definitions and Percentage of Correct Definitions Which Were Good, Fair and Weak	49
12. Showing the Ability of the Different Grades to Use the Words Correctly, Select Synonyms, Recognize Correct Usage and Showing Also a Measure of Connotation for Each Grade	52
13. Knowledge Scores of the Grades as Per Cents of the University Knowledge Score for the Word Principle	54





## CHAPTER I

### THE PROBLEM

The problem was to "estimate the increasing richness of language concepts over the period of years from grade VI to grade XII inclusive." Although the investigation does measure indirectly the extent of the student's vocabulary, the prime purpose was to test as comprehensively as possible the connotations, shades of meaning, and range of significance of the students' knowledge of the words.

According to Dorothea McCarthy of the University of Minnesota, most language studies, which have already been undertaken, have dealt with the language development of the pre-school child. These investigations have covered "appearance of the first word", "extent of understood vocabulary at different ages", "the gaining of control of the vocal organs", etc. No investigation exactly parallel to our own has apparently been carried out. We have, therefore, no norms or other results which may be used for comparison with what we have found. However, a comparison of the two sets of data collected by Mr. McLachern and myself should prove of some interest.

In my own investigation the words selected are words that Grade Nine students need to know in their study of General Science. My concern has been to find out as nearly as possible the richness of the meaning which students have associated with these words. As a rule students are not very critical of their own vocabulary. They may grasp the meaning of the word from its context or they may assign it a meaning of their own according to some pre-existing schema. This leads to an inexact knowledge of words which will seriously handicap the student in his effort to obtain first hand knowledge from books. It would have the same effect on the student's ability to interpret spoken language. This study of language concepts may throw some light on



the generally poor standard of work in our secondary schools. It may also indicate that there is something at fault with the formal teaching of words in schools.

## CHAPTER II

### APPROACH TO THE PROBLEM

There are two direct methods for discovering a student's knowledge of a word, namely, the oral and written. In the oral examination the student may talk freely as his mental associations with the word prompt him. His remarks may be followed up by careful and varied questioning in order to probe the soundness of his knowledge and the range of it. He is not confined by a set system of questions to certain lines of thought. Actual preliminary oral testing, however, did not prove particularly successful. Students were unable to divulge, on the spur of the moment, a great deal of information about the word especially with regard to its finer shades of meaning and special uses. It was found that the type of questioning would need to vary considerably with different students so that the scoring had to be done too & still tried there was no reliable means of taking down the student's discussion and responses verbatim. Some students were handicapped by shyness and some seemed to be slightly on the defensive. The amount of time required for the oral testing of a sufficiently representative group of students was not at all disposed and so the oral testing was, for the time being, abandoned.

In the circumstances that prevailed the written type of test offered the following advantages: 1. It brings out the student's knowledge quite fully provided the test is comprehensive and suggestive; 2. the experienced students have had in written tests placed them at their ease; 3. large numbers of students can be tested simultaneously;



4. the amount of material can easily be varied since all students can take the test at the same period; 5. the test is uniform in content and is uniform in administration to all students thus making it more objective; 6. a uniform system of scoring can be used; 7. as members of a group students are not on the defensive and will put forth a good effort; 8. the time required for testing is not great; 9. a permanent record is provided for scoring and analysis; 10. students have time to deliberate before putting down their answers.

.. disadvantage soon observed in the written tests was the fact that in some cases students defined the word through the helpful suggestiveness of some of the other questions. However, the student even there had to discriminate between right and wrong and if he selected the wrong concept it added to his error score.

With the foregoing considerations in mind, the written form of test was finally selected. Considerable oral questioning was done between tests in order to determine if the tests were covering all shades of meaning of the word and also to find if students were quite clear in their minds as to the procedure to be followed in answering. As a result of this oral questioning certain changes were made in the tests in order to improve them.

#### CONSTRUCTION OF THE TEST

In order to construct a suitable test the following guiding principles were employed: 1. the test should cover all meanings and applications of the word; 2. tests should not reflect the investigator's bias; 3. there should be as great objectivity as possible; 4. such qualities as denotation, connotation, degree of abstraction, extent of knowledge should be measured separately in so far as that is possible; 5. the tests should measure the students' ability, to use



the word correctly, to define the word, to recognize correct usage of it, to select its synonyms; 6. each word must be treated in such a way as to test its meaning and uses fully rather than attempt to keep to a standard form for all words; 7. it should be possible to measure both knowledge and error associated with the word.

The advantage of having Mr. McLachern working with me in the construction of the tests was very great. We were able, by putting our questions to each other, to increase the objectivity of the tests, eliminate faulty questions, get the point of view of the person answering the test, increase comprehensiveness and range, etc. We are now able to see many ways in which the tests might have been improved but at the time many faults were eliminated by our consultations while actually constructing the tests.

At first it was thought that a great many words could be tested. However, the work involved was far greater than had been anticipated. Only twelve words were used for the actual investigation but considering the number of words involved in the construction of each test, it is obvious that the final score of each student reflects his knowledge of a wide vocabulary. The tests are included here in the order in which they were given to the students. Changes will be noticed in the form after the first few tests and this was in an attempt to improve the tests. Two questions were added. One was to find out if the student knew anything about the word which the test did not cover and so check the comprehensiveness of the tests. The other question added was to check the clarity of the questioning from the point of view of the person answering the test.





Word Meaning Test #1. Nov. 15.

Name \_\_\_\_\_ Grade \_\_\_\_\_ Born: Year \_\_\_\_\_ Mo. \_\_\_\_\_ Day \_\_\_\_\_ No. \_\_\_\_\_

Test Word -- ATMOSPHERE.

1. Do you know the exact meaning of this word? yes--no.
2. Use the word in a sentence which shows its meaning.
3. Define the word as completely as you can.
4. Mark each of the following as true or false:
  - (a) \_\_\_\_\_ The moon has very little atmosphere.
  - (b) \_\_\_\_\_ The earth's atmosphere is thinner at higher altitudes.
  - (c) \_\_\_\_\_ A slum can have a social atmosphere.
  - (d) \_\_\_\_\_ A church service has a religious atmosphere.
  - (e) \_\_\_\_\_ There is always a studious atmosphere in a classroom.
  - (f) \_\_\_\_\_ The moral atmosphere of the home is always good.
  - (g) \_\_\_\_\_ Bernard Shaw creates a literary atmosphere.
5. The word belongs to what part of speech? \_\_\_\_\_  
Write the adjective form of the word. \_\_\_\_\_
6. In what school subject is the word often used? \_\_\_\_\_
7. Underline in the following list any of the characteristics or qualities of atmosphere: weight, plant, feeling, depth, gases, balloon, wagon, wind, moisture, buoyancy, pressure, emotion, plain, time, compressibility, color, heat.
8. Is the word correctly used in each of the following sentences?
  - (a) The atmosphere of factory cities is often contaminated with dust. correct--incorrect.
  - (b) The teacher said he did not like the atmosphere of the student's handwriting. correct--incorrect.
  - (c) You have a mysterious atmosphere. correct--incorrect.
  - (d) Canada's political atmosphere is opposed to radicalism. correct--incorrect.
9. Underline the words whose meaning is near that of Atmosphere: gas, climate, ether, air, ship, background, ocean, influence.
10. Write a paragraph telling anything else you know about the word atmosphere.



Word Meaning Test # 2. Nov. 22.

Name---- Grade--- Born: Year--- Mo.--- Day---- No.----

Test Word --INVENT.

1. Do you know the exact meaning of this word? yes--no.
2. Use the word in a sentence which shows its meaning.
3. Define the word as completely as you can.
4. Mark each of the following as true or false:
  - (a) \_\_\_\_\_ Columbus was a great inventor.
  - (b) \_\_\_\_\_ Human beings invented machines.
  - (c) \_\_\_\_\_ A student could invent an excuse for being late.
  - (d) \_\_\_\_\_ An author may invent the characters in his story.
  - (e) \_\_\_\_\_ Edison was one of the inventors of the electric light.
5. To what part of speech does the word belong? \_\_\_\_\_  
Write the noun form of the word. \_\_\_\_\_  
Write the adjective form of the word. \_\_\_\_\_
6.
  - (a) Invent is most like create, produce, sustain.
  - (b) Invent is most like obligate, design, examine.
  - (c) Invent is most like obtain, originate, arrive.
  - (d) Invent is most like concoct, approach, transact.
  - (e) Invent is most like play, compare, devise.
  - (f) Invent is most like compose, consume, confer.
  - (g) Invent is most like order, fabricate, induce.
  - (h) Invent is most like frame, explain, convince.
  - (i) Invent is most like restrict, fashion, announce.
  - (j) Invent is most like contrive, surround, overtake.
7. Is the word correctly used in each of the following sentences?
  - (a) A man may try to invent a new machine.
  - (b) Some doctors are attempting to invent a cure for cancer.
  - (c) He invented a lie.
  - (d) Newton invented gravitation.
  - (e) My neighbor has an inventive mind.
  - (f) There are still many inventible devices.
  - (g) Mathematics is an invention.
8. Pick out the name of a great inventor from the following list: Babe Ruth, Marconi, Dempsey, Stanley Baldwin.
9. Explain briefly any difficulty you had in answering any question.
10. Tell anything else you know about the word invent.



Word Meaning Test # 3. Nov. 29.

Name \_\_\_\_\_ Grade \_\_\_\_\_ Born: Year \_\_\_\_ Mo. \_\_\_\_ Day \_\_\_\_ No. \_\_\_\_

Test Word --EXPERIMENT.

1. Do you know the exact meaning of this word? Yes \_\_\_\_ No \_\_\_\_
2. Use the word in a sentence which shows its meaning.
3. Define the word as completely as you can.
4. Mark each of the following as true or false:
  - (a) \_\_\_\_\_ Scientific knowledge is advanced by experiment.
  - (b) \_\_\_\_\_ Experiments are always successful.
  - (c) \_\_\_\_\_ Experiments are sometimes performed to test the truth of predictions or beliefs.
  - (d) \_\_\_\_\_ You must always have apparatus to do experiments.
  - (e) \_\_\_\_\_ An experiment always involves activity.
  - (f) \_\_\_\_\_ Russia is conducting a social experiment.
  - (g) \_\_\_\_\_ New discoveries are often made by means of experiments.
5. Write as many other forms of the word as you know and use each form correctly in a sentence.
  - (a) Form of word \_\_\_\_\_ Used in a sentence \_\_\_\_\_
  - (b) Form of word \_\_\_\_\_ Used in a sentence \_\_\_\_\_
  - (c) Form of word \_\_\_\_\_ Used in a sentence \_\_\_\_\_
  - (d) Form of word \_\_\_\_\_ Used in a sentence \_\_\_\_\_
6. Experiment is most like supply, trial, circus, amount, obligation.  
Experiment is most like product, place, test, rampart, radius.  
Experiment is most like investigation, condition, despair, idea.  
Experiment is most like judgement, solution, exploration, decision.  
Experiment is most like play, practice, correction, advice, renewal.  
Experiment is most like probing, fencing, reviewing, motoring.  
Experiment is most like comprehension, manifestation, examination.
7. Underline in the following list the names of places where experiments are often performed: moon, school, laboratory, theatre, store, elevator, hospital, church, factory, saloon.
8. Is the word correctly used, according to its meaning, in each of the following sentences?
  - (a) The experiment heard what I was saying.
  - (b) Chemistry students do experiments.
  - (c) The weather experiments on people.
  - (d) Medical men are experimenting to find a cure for cancer.
9. Tell briefly about any experiment you have done or have seen others do.
10. Explain briefly any difficulty you had in answering any question.
11. Tell anything else about the word which you may know.



Word Meaning Test # 4. Dec. 6.

Name \_\_\_\_\_ Grade \_\_\_\_\_ Born: Year \_\_\_\_\_ Mo. \_\_\_\_\_ Day \_\_\_\_\_ No. \_\_\_\_\_

Test Word--GRAVITY.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word in a sentence which shows its meaning.
3. Define the word as completely as you can.
4. Gravity causes: weight, rotation of the earth, winds, air pressure, acceleration in the velocity of falling bodies, landslides, time, seasons, molecular motion, the solar system to cohere, all bodies to attract each other, water to seek its own level, trees to grow straight, latitude, tides, the earth to fall toward the sun.
5. Gravity is always present, intense, measurable, contagious, universal, continuous, repellent, mutual.
6. Gravity is altered by: distance from the body's center, weather, mass, temperature, inclination of the earth's axis to the plane of its orbit, weight.
7. Mark each of the following as true or false:
  - (a) \_\_\_\_\_ A barometer measures gravity.
  - (b) \_\_\_\_\_ All objects are bound to the earth by gravity.
  - (c) \_\_\_\_\_ Centrifugal force opposes gravity.
  - (d) \_\_\_\_\_ The moon has lost its atmosphere because of its low force of gravity.
  - (e) \_\_\_\_\_ If gravity were greater we could jump higher.
8. Is the word correctly used, according to its meaning, in the following expressions? law of gravity, gravity of the room, center of gravity, the gravity of the situation, gravity of the sky, force of gravity, the gravity of the judge, gravity of the sermon, gravity of the senate, gravity of the musical note, gravity of a light.
9. Write as many other forms of the word as you know and use each form correctly in a sentence.
  - (a) Form of word- \_\_\_\_\_ Used correctly-
  - (b) Form of word- \_\_\_\_\_ Used correctly-
  - (c) Form of word- \_\_\_\_\_ Used correctly-
  - (d) Form of word- \_\_\_\_\_ Used correctly-
10. Gravity is most like seriousness, soundness, solicitation. Gravity is most like ability, avarice, solemnity, secretiveness. Gravity is most like mobility, motility, momentousness, mode. Gravity is most like detraction, attraction, subtraction, action. Gravity is most like maturity, obesity, dignity, obscurity.
11. Explain briefly any difficulty you had in answering any question.
12. Tell anything else you know about the word gravity.





Word Meaning Test #5. Dec. 13.

Name \_\_\_\_\_ Grade \_\_\_\_\_ No. \_\_\_\_\_

Test Word is PRINCIPLE.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.
3. Define the word as completely as you can.
4. Is the word correctly used, according to its meaning, in the following sentences?
  - (a) \_\_\_\_\_ The man has good principles.
  - (b) \_\_\_\_\_ He is the principle of the school.
  - (c) \_\_\_\_\_ Machines depend on certain principles.
  - (d) \_\_\_\_\_ The clergyman principled his congregation.
  - (e) \_\_\_\_\_ The chemist discovered the poison principle in the drug.
  - (f) \_\_\_\_\_ The race was the principle event of the day.
5. Explain each of the following in a sentence:
  - (a) moral principle-
  - (b) religious principle-
  - (c) political principle-
  - (d) principle of nature-
  - (e) economic principle-
  - (f) principle of the universe-
  - (g) artistic principles-
  - (h) man of principles-
  - (i) mathematical principle-
  - (j) scientific principle-
6. Principle is most like cause, excuse, reason, need.  
Principle is most like duration, beginning, start, origin.  
Principle is most like command, law, order, arrangement.  
Principle is most like motive, energy, desire, statement.  
Principle is most like saying, adage, axiom, belief.
7. A principle may be discovered, disproven, selfish, formulated, fumigated, ~~altered~~, undesirable, sued, disobeyed.
8. Which of the following may be called principles?  
honesty, regret, happiness, distress, truthfulness, progress, ocean, dream, gravitation, sincerity, monogamy, dollar.
9. What is the underlying principle governing the operation of each of the following?
  - (a) barometer-
  - (b) thermometer-
  - (c) balloon-
  - (d) aeroplane-
  - (e) law-
  - (f) coasting-
  - (g) government-
10. Explain briefly any difficulty you had in answering any question.
11. Tell anything else you know about the word principle.



Word Meaning Test # 6. Jan. 10, 1936.

Name \_\_\_\_\_ Grade \_\_\_\_\_ Born: Year \_\_\_\_\_ Mo. \_\_\_\_\_ Day \_\_\_\_\_ No. \_\_\_\_\_

Test Word is ELEMENT.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.
3. Define the word as completely as you can.
4. Element is most like rudiment, quantity, allotment, amount.  
Element is most like rule, principle, regulation, theory.  
Element is most like elixir, emanation, essence, extract.  
Element is most like ingredient, part, component, constituent.
5. Write as many other forms of the word as you know and use each form correctly in a sentence.
  - (a) Form of word- Used correctly-
  - (b) Form of word- Used correctly-
  - (c) Form of word- Used correctly-
6. Which of the following uses of the word element are correct?
  - (a) \_\_\_\_\_ A fish out of water is out of its element.
  - (b) \_\_\_\_\_ He enjoyed looking at the element of the sunset.
  - (c) \_\_\_\_\_ Can you element this problem?
  - (d) \_\_\_\_\_ There was an element of fear in his manner.
  - (e) \_\_\_\_\_ Chemists are interested in the possibility of the transmutation of elements.
  - (f) \_\_\_\_\_ The aviator braved the elements in crossing the Atlantic.
  - (g) \_\_\_\_\_ The garage sold out all its automobile elements.
  - (h) \_\_\_\_\_ He was right in his element at the party.
7. Which of the following are elements? wood, iron, water, soap, oxygen, soil, paper, tin.
8. Mark each of the following as true or false:
  - (a) \_\_\_\_\_ All elements are solids.
  - (b) \_\_\_\_\_ The smallest division of an element is the molecule.
  - (c) \_\_\_\_\_ Matter is composed of elements.
  - (d) \_\_\_\_\_ War may have an element of danger.
  - (e) \_\_\_\_\_ Chalk can be reduced to elements with a hammer.
9. An element may be discovered, examined, a gas, a liquid, changed from a solid to a liquid, rare, soluble in water, alarming, sad.
10. Explain each of the following:
  - (a) elementary school--
  - (b) elemental passions--
  - (c) chemical element--
  - (d) social element--
11. Tell anything else you know about the word element.



Word Meaning Test # 7. Jan. 17.

Name \_\_\_\_\_ Grade \_\_\_\_\_ Born: Year \_\_\_\_\_ Mo. \_\_\_\_\_ Day \_\_\_\_\_ No. \_\_\_\_\_

Test word is NATURE.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.
3. Define the word as completely as you can.
4. (a) Nature is most like universe, nation, city, area.  
(b) Nature is most like religion, formation, creation, stagnation.  
(c) Nature is most like appearance, property, quantity, quality.  
(d) Nature is most like composition, constitution, conformation.
5. Which of the following sentences use the word nature correctly according to its meaning?  
(a) \_\_\_\_\_ What was the nature of the situation?  
(b) \_\_\_\_\_ He is a lover of nature.  
(c) \_\_\_\_\_ Measles is a nature disease.  
(d) \_\_\_\_\_ Some people have generous natures.  
(e) \_\_\_\_\_ He speaks nature.  
(f) \_\_\_\_\_ They did not like the nature of my remarks.
6. Which of the following are produced directly by nature?  
trees, cyclones, watches, lakes, books, glaciers, glass, mountains, nature study, governments, aeroplanes, animals, fences, houses, solar system, rainfall, science.
7. Mark each of the following as true or false:  
(a) \_\_\_\_\_ It is natural for people to walk on their hands.  
(b) \_\_\_\_\_ Human beings are a part of nature.  
(c) \_\_\_\_\_ Nature is bound by its own laws.  
(d) \_\_\_\_\_ Natural phenomena are artificial.  
(e) \_\_\_\_\_ Night follows day in the natural order of events.  
(f) \_\_\_\_\_ In nature every cause has its effect.  
(g) \_\_\_\_\_ Man can control all the forces of nature.
8. Explain each of the following:  
(a) Law of nature--  
(b) Human nature--  
(c) Natural history--  
(d) Natural behavior--  
(e) Natural consequence--  
(f) Nature study--  
(g) Forces of nature--  
(h) Natural man--  
(i) Naturalism.--  
(j) Naturalization--  
(k) Good--natured--
9. Tell anything else you know about the word nature.



Word Meaning Test # 8. Jan. 24.

Name \_\_\_\_\_ Grade \_\_\_\_\_ Born: Year \_\_\_\_\_ Mo. \_\_\_\_\_ Day \_\_\_\_\_ No. \_\_\_\_\_

Test word is BUOYANCY.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.
3. Define the word as completely as you can.
4. (a) Buoyancy is most like cheerfulness, sorrow, despair, love.  
(b) Buoyancy is most like force, lifting effect, pressure, influence.  
(c) Buoyancy is most like seriousness, frivolity, light-heartedness.
5. Mark each of the following as true or false:  
(a) \_\_\_\_\_ A liquid may have buoyancy.  
(b) \_\_\_\_\_ Buoyancy of the air keeps balloons afloat.  
(c) \_\_\_\_\_ A buoyant person is seldom depressed.  
(d) \_\_\_\_\_ All liquids have the same buoyancy.  
(e) \_\_\_\_\_ A person may have a buoyant disposition.  
(f) \_\_\_\_\_ The moon's buoyancy keeps it from falling to the earth.  
(g) \_\_\_\_\_ A stone, when lifted while it is under water, appears to be lighter owing to the buoyant action of the water.  
(h) \_\_\_\_\_ A policeman always wears a lifebuoy.  
(i) \_\_\_\_\_ The buoyancy of a liquid is greater at greater depths.
6. Which of the following sentences use the underlined word correctly?  
(a) \_\_\_\_\_ He walked buoyantly.  
(b) \_\_\_\_\_ His hope was buoyed up by the news.  
(c) \_\_\_\_\_ The traffic policeman buoyed his way through the crowd.  
(d) \_\_\_\_\_ I spoke to the buoy and he replied at once.  
(e) \_\_\_\_\_ He intends to buoy a horse at the sale.  
(f) \_\_\_\_\_ The student buoyed the book from the floor and placed it on the desk.  
(g) \_\_\_\_\_ The canoe went buoyantly over the waves.
7. Buoyancy, gravity, depth, driven, brick, lifebuoy, sailed, buoyed, buoy, sad, buoyantly, light, buoyant, balanced.  
From the above list of words select a word to fill each of the blanks in the following sentences:  
(a) Because of the \_\_\_\_\_ of water many things float on it.  
(b) The sailor threw a \_\_\_\_\_ to the man who had fallen overboard.  
(c) The hydrogen balloon was \_\_\_\_\_ up by the air.  
(d) The clown \_\_\_\_\_ the apple on his nose.  
(e) A \_\_\_\_\_ may be used to warn sailors of the presence of rocks.  
(f) He replied quite \_\_\_\_\_ to my questions.  
(g) Cork is more \_\_\_\_\_ than iron.
8. Answer yes or no in each of the following cases:  
(a) \_\_\_\_\_ A block of wood is cut in half. Does this increase its buoyancy?  
(b) \_\_\_\_\_ A person is swimming in water. Does this involve buoyancy?  
(c) \_\_\_\_\_ Is skating possible because of the buoyancy of ice?  
(d) \_\_\_\_\_ An object is weighed with a spring scale. Does the buoyancy of the air affect the reading of the scale?  
(e) \_\_\_\_\_ Does sanguine mean nearly the same as buoyant?
9. Tell anything else you know about the word.





Word Meaning Test # 9. Jan. 31.

Name \_\_\_\_\_ Grade \_\_\_\_\_ Born: Year \_\_\_\_\_ Mo. \_\_\_\_\_ Day \_\_\_\_\_ No. \_\_\_\_\_

Test Word is Solution.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.
3. Define the word as completely as you can.
4. Solution is most like explanation, examination, observation.  
Solution is most like doing home work, solving a problem,  
playing a game, eating dinner.  
Solution is most like a solid dissolved in a liquid,  
flour mixed with water, pure water, gasoline.
5. Mark each of the following as true or false:  
(a) \_\_\_\_\_ Sugar mixed with water forms a solution.  
(b) \_\_\_\_\_ There is a solution for every problem.  
(c) \_\_\_\_\_ A solution has uniform properties.  
(d) \_\_\_\_\_ Kerosene is a solution.  
(e) \_\_\_\_\_ Only chemists can make solutions.  
(f) \_\_\_\_\_ A mystery may have a solution.  
(g) \_\_\_\_\_ Brine is a solution.
6. Which of the following sentences use the word underlined correctly?  
(a) \_\_\_\_\_ The student was attempting the solution of the problem.  
(b) \_\_\_\_\_ He could not solution his friend to go with him.  
(c) \_\_\_\_\_ Can you find a solution for the riddle?  
(d) \_\_\_\_\_ The chemist drove the gas out of solution by means of heat.  
(e) \_\_\_\_\_ He made a solution of iron filings and salt.
7. A solution may be clear, homogeneous, easy, involved, heterogeneous, turbid, musical, late.
8. Solution, dissolve, anticipate, solve, repair, solvent, object, solute, debtor, solvency, resolution, solvable,  
In the following sentences fill each blank with a suitable word from the above list:  
(a) He could not find a \_\_\_\_\_ for the problem.  
(b) A student may \_\_\_\_\_ a problem.  
(c) In brine water is the \_\_\_\_\_ and salt is the \_\_\_\_\_.  
(d) The \_\_\_\_\_ of the firm is well known.  
(e) Not every problem is \_\_\_\_\_.  
(f) Sugar will \_\_\_\_\_ in water.  
(g) He made a New Year's \_\_\_\_\_.
9. Explain each of the following:  
(a) Concentrated solution---  
(b) Saturated solution---  
(c) Dilute solution---
10. Answer yes or no to each of the following sentences:  
(a) \_\_\_\_\_ Water freezes at 0 degrees Centigrade. Will brine freeze at 0 degrees Centigrade?  
(b) \_\_\_\_\_ Water boils at 100 degrees Centigrade. Will brine boil at 100 degrees Centigrade?  
(c) \_\_\_\_\_ Will a solution settle?  
(d) \_\_\_\_\_ Is muddy water a solution?  
(e) \_\_\_\_\_ May a problem have more than one solution?
11. Tell anything else you know about the word "solution".



Word Meaning Test # 10. Feb. 7.

Test Word is THEORY.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.
3. Define the word as completely as you can.
4. Theory is most like imagination, pretention, supposition, idea.  
Theory is most like speculation, thinking, rumor, belief.  
Theory is most like assumption, condition, hypothesis, rule.  
Theory is most like cause, origin, law, consequence.
5. Which of the following are theories? Answer yes or no.
  - (a) Air has weight.
  - (b) Spring follows winter.
  - (c) The earth revolves around the sun.
  - (d) A magnet points North and South.
  - (e) Human beings evolved from lower forms of life.
  - (f) Two and two are four.
  - (g) Matter is composed of small particles called molecules.
  - (h) Light is a wave motion.
  - (i) We see with our eyes.
  - (j) City life is more desirable than country life.
  - (k) Boys have better memories than girls.
  - (l) I thought the man whom I saw walking down the street was Mr. Jones.
6. Theory, proposition, theorist, speculator, theoretical, theorize, actual, theoretically, politician, practical, practice.  
In the following sentences fill each blank with a suitable word from the above list:
  - (a) Einstein is a famous\_\_\_\_\_.
  - (b) The student found the mathematics course more \_\_\_\_\_ than \_\_\_\_\_.
  - (c) The statement, "the angles at the base of an isosceles triangle are equal", is a \_\_\_\_\_.
  - (d) Woodworking is more \_\_\_\_\_ than \_\_\_\_\_.
  - (e) \_\_\_\_\_ the plan appeared sound but it failed in \_\_\_\_\_.
  - (f) An inventor must do more than \_\_\_\_\_ to create an invention.
  - (g) The \_\_\_\_\_ of medicine has been built up by years of experimentation and study.
7. Mark each of the following as true or false:
  - (a) \_\_\_\_\_ An hypothesis that has been fully verified becomes a theory.
  - (b) \_\_\_\_\_ A theory may be false.
  - (c) \_\_\_\_\_ All theories can be applied in practice.
  - (d) \_\_\_\_\_ A mastery of the theory of a trade may improve the practice of it.
  - (e) \_\_\_\_\_ There is a theory of music.
  - (f) \_\_\_\_\_ Some scientific theories are more firmly established than others.
8. What is meant by the following?
  - (a) Theory of evolution---
  - (b) The theory of divine right--
  - (c) The quadratic theory---
  - (d) Artistic theory--



Word Meaning Test # 11. Feb. 14.

Test Word is MACHINE.

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.
3. Define the word as completely as you can.
4. (a) Machine is most like appliance, novelty, object, thing.  
(b) Machine is most like manipulation, decoy, device, means.  
(c) Machine is most like convoy, contrivance, contraband, corral.  
(d) Machine is most like institution, invoice, invention, traffic.  
(e) Machine is most like implement, improvement, implication.  
(f) Machine is most like utopia, utensil, utility, usefulness.  
(g) Machine is most like instrument, institution, quality, amount.
5. Implement, immature, toil, taboo, tools, appliance, decoy, device, utensil, use, utility, toy, machinery, mechanic, institution, instrument.  
In the following sentences fill each blank with the most suitable word from the above list:  
(a) A plow is an agricultural \_\_\_\_\_.  
(b) A carpenter uses many different \_\_\_\_\_ in his work.  
(c) An egg beater is a kitchen \_\_\_\_\_.  
(d) A surgical \_\_\_\_\_ must be sterilized before it is used.  
(e) Edison invented a new electrical \_\_\_\_\_.  
(f) All the farm \_\_\_\_\_ was in need of repair.  
(g) The motor \_\_\_\_\_ was repairing the automobile.
6. Is the underlined word used correctly according to its meaning in each of the following sentences? Answer yes or no.  
(a) \_\_\_\_\_ He is mechanically inclined.  
(b) \_\_\_\_\_ Sir Malcolm Campbell drove his machine at great speed.  
(c) \_\_\_\_\_ I sent my watch to a watch mechanic to be repaired.  
(d) \_\_\_\_\_ The actors and actresses played their parts mechanically.  
(e) \_\_\_\_\_ Huey Long was the leader of a well organized political machine.  
(f) \_\_\_\_\_ A dictionary is a machine for teaching word meanings.  
(g) \_\_\_\_\_ The lumber had been well machined.
7. The names of six machines are given in the following list. Underline them.  
lever, rope, sack, pulley, spectacles, wheel and axle, house, inclined plane, window, screw, student, wedge, suit, desk.
8. Mark each of the following as true or false:  
(a) \_\_\_\_\_ Primitive man had very few machines.  
(b) \_\_\_\_\_ Machines are a source of power.  
(c) \_\_\_\_\_ Machines may transform one kind of energy to some other form of energy.  
(d) \_\_\_\_\_ A machine can deliver more power than is put into it.  
(e) \_\_\_\_\_ Some machines are automatic.  
(f) \_\_\_\_\_ Increased use of machinery indicates progress in civilization.  
(g) \_\_\_\_\_ Machinery never wears out.
9. Explain each of the following:  
(a) Mechanical advantage--  
(b) The mechanical powers--  
(c) Robot--  
(d) Machine age-----



Word Meaning Test #12. Feb. 25.

Name \_\_\_\_\_ Grade \_\_\_\_\_ BORN: Year \_\_\_\_\_ Month \_\_\_\_\_ Day \_\_\_\_\_ No. \_\_\_\_\_

Test word is ENERGY

1. Do you think you know the meaning of this word? Yes--No.
2. Use the word correctly in a sentence.

3. Define the word as completely as you can.

4. Energy is most like strength, opinion, sobriety, quality.  
Energy is most like possession, advice, power, policy.  
Energy is most like folly, fiction, fastidiousness, force.  
Energy is most like vigor, value, velocity, verity.  
Energy is most like efficiency, efficacy, effect, effort.

5. energy, sobriety, strength, opinion, quality, power, advice, folly, force, value, vigor, efficacy, effort, sound.

Fill each of the blanks in the following sentences with the most suitable word from the above list:

- (a) The \_\_\_\_\_ of the engine is equal to that of twenty horses.
- (b) Bodily and mental \_\_\_\_\_ is an ordinary accompaniment of youth.
- (c) The patient was gratified with the \_\_\_\_\_ of the treatment.
- (d) The \_\_\_\_\_ of the water at Niagara Falls is used to generate electrical \_\_\_\_\_.
- (e) An elephant has greater \_\_\_\_\_ than a horse.
- (f) The \_\_\_\_\_ of the wind held us back.
- (g) He made an \_\_\_\_\_ to lift the stone.

6. Mark each of the following as true or false:

- (a) \_\_\_\_\_ There is more than one kind of energy.
- (b) \_\_\_\_\_ Energy is a substance.
- (c) \_\_\_\_\_ Energy of one kind may be transformed to some other kind.
- (d) \_\_\_\_\_ The amount of energy in the universe is constant.
- (e) \_\_\_\_\_ A rock weighing ten pounds contains more energy than a lump of coal weighing ten pounds.
- (f) \_\_\_\_\_ Sunlight supplies energy to make plants grow.
- (g) \_\_\_\_\_ It takes energy to do work.
- (h) \_\_\_\_\_ Energy may be bought or sold.

7. Which of the following are sources of energy?  
sun, moon, coal, water, wood, straw, soil, stone, wind, running water, plants, air, stars, cloth, tin, paper, glass iron, ice.

8. Explain the following:

- (a) Potential energy--
- (b) Kinetic Energy--
- (c) Conservation of Energy--
- (d) Latent Energy--

9. How do human beings maintain their energy? Answer--

1. Have you found these word tests helpful? Yes--No.
2. If you answered yes to the above question, tell as fully as you can how you consider these tests to be beneficial.





### Administering the Tests.

The tests were written by the students at three o'clock on Friday afternoons on the dates shown on the tests. The students were supervised by their own teachers. No information which would help the students in answering was given out but students were allowed to ask questions concerning procedure and were given as much time as they required to finish the tests. All students were asked to do their very best on the tests. Very few cases occurred in which the students did not make a really serious effort.

In order to arrive at a sort of maturity score, a set of tests on the word "principle" was sent to Dr. Lazerte, director of the School of Education at the University of Alberta. Dr. Lazerte gave these tests to a senior class at the university and returned them to me. The results of these tests are included in the report. It also seemed important to find out what type of score would be made by students who possessed little or no knowledge of the test words. In order to do this some of the tests were given this term in grades IV and V.

The chronological ages of all students who wrote the tests were recorded as at January 1, 1936. This date was approximately the middle of the testing period.

Immediately following the completion of all the tests the students wrote the "Otis Self-Administering Test of Mental Ability." The intermediate form of this test was given to Public School students and the Higher form to students of the High School. From the I.Q.'s obtained the mental age of each student was worked out and recorded and has been used in the analysis of results of the tests.



### Scoring

The scoring of these tests was a problem which required considerable thought and the system used is of course subject to criticism. The questions which made the greatest demands on the students' original powers, i.e. the questions in which answers were not suggested, seemed most valuable. These questions were No.2, which asked the student to use the word correctly in a sentence and No.3, which asked for the definition of the word. For question No.2 a maximum score of three points was allowed. If the student gave a sentence using the word with an incorrect meaning he was given one point for error. Thus knowledge received more emphasis than error on this question. In question No. 3 one point was given for each correct, distinct definition without an upper limit being set. One point was also given for each error concept in the definition. No score was allotted in question 1. In all the other questions one point was given for each correct response and one point for each incorrect response. Questions not attempted were not scored. There was no upper limit score set for any test. Students' scores were carefully recorded.

The complete data collected in this investigation is summarized in the following pages.



CHAPTER III  
SUMMARY OF DATA.

CLASS SCORES  
GRADES VI TO XII



CLASS SCORES      GRADE VI

Student's Number	Chronological age	I. Q.	Mental Age	Rank in Mental Age	Aver. K. Score (H)	Aver. K. Score (S)	Aver. E. Score (H)
1	11-8	101	12-2	22	13.8	14.3	10.7
2	12-4	99	12-6	18	13.3	15.0	15.4
3	12-0	91	11-0	27.5	14.1	11.2	11.2
4	13-11	95	12-11	13.5	16.2	15.5	12.1
5	12-2	89	10-10	29	11.2	14.8	17.5
6	14-10	81	11-5	25	16.4	16.2	15.7
7	13-11	97	13-3	10.5	13.5	12.6	10.4
8	12-10	98	12-8	16	9.0	10.3	9.1
9	12-8	98	12-6	18	16.4	15.8	13.1
10	12-4	84	10-4	30.5	11.2	11.5	12.5
11	12-11	107	12-3	10.5	13.7	12.4	10.6
12	12-6	90	11-3	26	11.7	9.7	14.1
13	14-10	95	13-5	8	16.6	16.9	12.0
14	12-4	97	12-2	22	12.6	14.2	12.2
15	12-11	100	13-1	12	15.3	15.9	11.0
16	12-8	99	12-6	18	15.3	15.6	12.6
17	12-4	84	10-4	30.5	13.5	15.8	14.8
18	12-11	85	11-0	27.5	13.6	11.8	14.2
19	11-11	112	14-4	4	15.7	15.3	11.2
20	11-8	106	12-11	13.5	16.3	17.7	10.5
21	13-10	77	10-3	32	13.2	11.4	13.2
22	11-4	122	15-2	1	19.3	15.8	12.7
23	11-6	118	14-8	2	13.4	12.2	7.7
24	11-0	107	13-5	8	14.6	14.8	11.3
25	12-7	107	14-0	5	16.8	14.8	9.5
26	14-9	88	12-4	20	12.0	11.7	9.1
27	12-11	98	12-10	15	9.4	12.0	8.8
28	14-9	85	12-0	24	13.2	12.3	12.6
29	13-7	99	13-5	8	16.0	14.6	12.1
30	13-6	106	14-6	3	11.7	12.0	6.3
31	13-7	101	13-10	6	14.2	11.1	12.4
32	13-4	96	12-2	22	11.8	12.0	10.9
N- 32	12-10	95.2	12-6		13.9	13.7	11.8

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### CLASS SCORES

GRADE VI

Student's Number	Aver. E. Score (S)	Rank in K Scores (H)	Rank in K Scores (S)	Rank in E Scores (H)	Rank in E Scores (S)	Ratio K/E (H)	Ratio K/E (S)	Language Spoken at Home.
1	10.9	15.	16	10	20	1.28	1.31	Eng.
2	11.6	21	11	30	24	0.86	1.28	Ital.
3	10.3	14	29	13.5	16.5	1.25	1.08	Ukr.
4	11.4	7	9	17.5	22.5	1.33	1.35	Ital.
5	13.0	29.5	13	32	30	0.64	1.13	Ital.
6	14.2	4.5	3	31	31	1.04	1.14	Ital.
7	8.8	18.5	18	7	11.5	1.20	1.43	Slav.
8	7.6	32	31	4.5	6	0.98	1.35	Slav.
9	10.8	4.5	6	25	19	1.25	1.46	Eng.
10	10.6	29.5	27	21	18	0.89	1.08	Pol.
11	8.8	16	19	9	11.5	1.29	1.40	Hung.
12	11.8	27.5	32	27	26.5	0.82	0.82	Ital.
13	10.3	3	2	16	16.5	1.38	1.64	Eng.
14	9.6	24	17	19	15	1.03	1.47	Ital.
15	8.0	10.5	4	12	8	1.39	1.98	Eng.
16	9.5	10.5	8	22.5	14	1.21	1.64	Eng.
17	12.8	18.5	6	29	29	0.91	1.23	Ger.
18	14.4	17	25	28	32	0.95	0.81	Ital.
19	11.8	9	10	13.5	26.5	1.40	1.20	Eng.
20	6.7	6	1	8	3	1.55	2.64	Pol.
21	11.9	22.5	28	26	28	1.00	0.95	Hung.
22	11.7	1	6	24	25	1.51	1.34	Eng.
23	6.3	20	21	2	2	1.74	1.93	Belg.
24	8.7	12	13	15	10	1.29	1.70	Ukr.
25	7.7	2	13	16	7	1.76	1.92	Ukr.
26	7.3	25	26	4.5	5	1.31	1.60	Ukr.
27	7.0	31	23	3	4	1.06	1.71	Eng.
28	9.3	22.5	20	22.5	13	1.04	1.32	Eng.
29	11.3	8	15	17.5	21	1.32	1.20	Ital.
30	3.2	27.5	23	1	1	1.85	3.75	Eng.
31	8.4	13	30	20	9	1.14	1.32	Ukr.
32	11.4	26	23	11	22.5	1.08	1.05	Boh.
N-32	9.9					1.17	1.38	



### CLASS SCORES

## GRADE VII

Student's Number	Chronological Age	I. Q.	Mental Age	Rank in Mental Age	Aver. K. Score (H <sub>D</sub> )	Aver. K. Score (S)	Average E. Score (H)
1	14-2	101	14-2	4	21.1	20.0	13.5
2	13-2	82	11-10	26	17.2	17.5	14.5
3	12-6	105	13-5	13	19.7	18.8	10.7
4	12-8	---	----	--	21.6	21.4	11.2
5	12-11	95	11-6	28.5	18.3	17.1	13.2
7	14-2	79	10-10	31	16.7	17.1	15.1
8	13-0	103	13-5	13	17.6	17.6	12.1
9	12-6	100	12-8	18.5	15.2	16.5	11.6
10	12-5	114	13-10	7	17.9	17.3	12.6
11	13-1	99	12-8	18.5	15.5	16.9	10.7
12	13-7	94	12-10	24.5	19.0	20.6	13.8
13	13-6	102	13-7	10	17.3	19.5	10.6
14	13-5	96	12-10	16.5	19.3	19.0	13.3
15	14-4	86	12-0	24.5	21.4	17.3	12.9
16	12-10	106	13-10	7	23.5	23.1	10.9
17	12-4	117	15-5	2	22.8	23.1	10.3
19	14-11	91	12-11	15	18.7	15.9	13.4
20	12-11	103	13-5	13	22.0	19.1	11.0
21	13-11	89	12-1	22.5	17.6	19.3	13.3
22	13-0	85	11-6	28.5	16.6	17.2	11.0
23	14-0	--	----	----	18.7	19.4	12.1
24	12-6	107	13-10	7	19.3	19.0	11.5
25	12-9	104	13-7	10	22.2	24.9	13.9
26	14-1	80	11-0	30	17.4	19.5	12.6
27	15-0	85	12-1	22.5	16.3	14.9	10.2
28	13-3	98	13-7	10	22.5	21.6	8.5
29	14-10	88	12-4	21	14.5	14.6	11.1
30	12-6	118	15-11	1	28.6	25.7	6.6
31	12-4	112	14-6	3	20.7	18.7	11.6
32	13-7	87	11-8	27	19.8	19.9	12.7
33	13-1	105	14-0	5	20.2	18.9	12.4
34	12-5	---	----	--	18.6	15.3	7.3
35	12-10	99	12-10	16.5	15.1	16.2	9.7
36	15-1	---	----	---	17.9	17.1	14.2
37	13-8	93	12-6	20	18.0	18.9	13.8
38	14-9	---	----	---	15.1	16.4	16.9
N-36	13-5	97.6	13-10		19.0	19.0	12.0

TABLE I									
Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction									
Concentration of the solution (M)	Time (min)	Volume of gas evolved (ml)	Rate of reaction (ml/min)	Concentration of the solution (M)	Time (min)	Volume of gas evolved (ml)	Rate of reaction (ml/min)	Concentration of the solution (M)	Time (min)
0.1	10	10	1.0	0.2	10	20	2.0	0.3	10
0.1	20	20	1.0	0.2	20	40	2.0	0.3	20
0.1	30	30	1.0	0.2	30	60	2.0	0.3	30
0.1	40	40	1.0	0.2	40	80	2.0	0.3	40
0.1	50	50	1.0	0.2	50	100	2.0	0.3	50
0.1	60	60	1.0	0.2	60	120	2.0	0.3	60
0.1	70	70	1.0	0.2	70	140	2.0	0.3	70
0.1	80	80	1.0	0.2	80	160	2.0	0.3	80
0.1	90	90	1.0	0.2	90	180	2.0	0.3	90
0.1	100	100	1.0	0.2	100	200	2.0	0.3	100
0.1	110	110	1.0	0.2	110	220	2.0	0.3	110
0.1	120	120	1.0	0.2	120	240	2.0	0.3	120
0.1	130	130	1.0	0.2	130	260	2.0	0.3	130
0.1	140	140	1.0	0.2	140	280	2.0	0.3	140
0.1	150	150	1.0	0.2	150	300	2.0	0.3	150
0.1	160	160	1.0	0.2	160	320	2.0	0.3	160
0.1	170	170	1.0	0.2	170	340	2.0	0.3	170
0.1	180	180	1.0	0.2	180	360	2.0	0.3	180
0.1	190	190	1.0	0.2	190	380	2.0	0.3	190
0.1	200	200	1.0	0.2	200	400	2.0	0.3	200
0.1	210	210	1.0	0.2	210	420	2.0	0.3	210
0.1	220	220	1.0	0.2	220	440	2.0	0.3	220
0.1	230	230	1.0	0.2	230	460	2.0	0.3	230
0.1	240	240	1.0	0.2	240	480	2.0	0.3	240
0.1	250	250	1.0	0.2	250	500	2.0	0.3	250
0.1	260	260	1.0	0.2	260	520	2.0	0.3	260
0.1	270	270	1.0	0.2	270	540	2.0	0.3	270
0.1	280	280	1.0	0.2	280	560	2.0	0.3	280
0.1	290	290	1.0	0.2	290	580	2.0	0.3	290
0.1	300	300	1.0	0.2	300	600	2.0	0.3	300
0.1	310	310	1.0	0.2	310	620	2.0	0.3	310
0.1	320	320	1.0	0.2	320	640	2.0	0.3	320
0.1	330	330	1.0	0.2	330	660	2.0	0.3	330
0.1	340	340	1.0	0.2	340	680	2.0	0.3	340
0.1	350	350	1.0	0.2	350	700	2.0	0.3	350
0.1	360	360	1.0	0.2	360	720	2.0	0.3	360
0.1	370	370	1.0	0.2	370	740	2.0	0.3	370
0.1	380	380	1.0	0.2	380	760	2.0	0.3	380
0.1	390	390	1.0	0.2	390	780	2.0	0.3	390
0.1	400	400	1.0	0.2	400	800	2.0	0.3	400
0.1	410	410	1.0	0.2	410	820	2.0	0.3	410
0.1	420	420	1.0	0.2	420	840	2.0	0.3	420
0.1	430	430	1.0	0.2	430	860	2.0	0.3	430
0.1	440	440	1.0	0.2	440	880	2.0	0.3	440
0.1	450	450	1.0	0.2	450	900	2.0	0.3	450
0.1	460	460	1.0	0.2	460	920	2.0	0.3	460
0.1	470	470	1.0	0.2	470	940	2.0	0.3	470
0.1	480	480	1.0	0.2	480	960	2.0	0.3	480
0.1	490	490	1.0	0.2	490	980	2.0	0.3	490
0.1	500	500	1.0	0.2	500	1000	2.0	0.3	500
0.1	510	510	1.0	0.2	510	1020	2.0	0.3	510
0.1	520	520	1.0	0.2	520	1040	2.0	0.3	520
0.1	530	530	1.0	0.2	530	1060	2.0	0.3	530
0.1	540	540	1.0	0.2	540	1080	2.0	0.3	540
0.1	550	550	1.0	0.2	550	1100	2.0	0.3	550
0.1	560	560	1.0	0.2	560	1120	2.0	0.3	560
0.1	570	570	1.0	0.2	570	1140	2.0	0.3	570
0.1	580	580	1.0	0.2	580	1160	2.0	0.3	580
0.1	590	590	1.0	0.2	590	1180	2.0	0.3	590
0.1	600	600	1.0	0.2	600	1200	2.0	0.3	600
0.1	610	610	1.0	0.2	610	1220	2.0	0.3	610
0.1	620	620	1.0	0.2	620	1240	2.0	0.3	620
0.1	630	630	1.0	0.2	630	1260	2.0	0.3	630
0.1	640	640	1.0	0.2	640	1280	2.0	0.3	640
0.1	650	650	1.0	0.2	650	1300	2.0	0.3	650
0.1	660	660	1.0	0.2	660	1320	2.0	0.3	660
0.1	670	670	1.0	0.2	670	1340	2.0	0.3	670
0.1	680	680	1.0	0.2	680	1360	2.0	0.3	680
0.1	690	690	1.0	0.2	690	1380	2.0	0.3	690
0.1	700	700	1.0	0.2	700	1400	2.0	0.3	700
0.1	710	710	1.0	0.2	710	1420	2.0	0.3	710
0.1	720	720	1.0	0.2	720	1440	2.0	0.3	720
0.1	730	730	1.0	0.2	730	1460	2.0	0.3	730
0.1	740	740	1.0	0.2	740	1480	2.0	0.3	740
0.1	750	750	1.0	0.2	750	1500	2.0	0.3	750
0.1	760	760	1.0	0.2	760	1520	2.0	0.3	760
0.1	770	770	1.0	0.2	770	1540	2.0	0.3	770
0.1	780	780	1.0	0.2	780	1560	2.0	0.3	780
0.1	790	790	1.0	0.2	790	1580	2.0	0.3	790
0.1	800	800	1.0	0.2	800	1600	2.0	0.3	800
0.1	810	810	1.0	0.2	810	1620	2.0	0.3	810
0.1	820	820	1.0	0.2	820	1640	2.0	0.3	820
0.1	830	830	1.0	0.2	830	1660	2.0	0.3	830
0.1	840	840	1.0	0.2	840	1680	2.0	0.3	840
0.1	850	850	1.0	0.2	850	1700	2.0	0.3	850
0.1	860	860	1.0	0.2	860	1720	2.0	0.3	860
0.1	870	870	1.0	0.2	870	1740	2.0	0.3	870
0.1	880	880	1.0	0.2	880	1760	2.0	0.3	880
0.1	890	890	1.0	0.2	890	1780	2.0	0.3	890
0.1	900	900	1.0	0.2	900	1800	2.0	0.3	900
0.1	910	910	1.0	0.2	910	1820	2.0	0.3	910
0.1	920	920	1.0	0.2	920	1840	2.0	0.3	920
0.1	930	930	1.0	0.2	930	1860	2.0	0.3	930
0.1	940	940	1.0	0.2	940	1880	2.0	0.3	940
0.1	950	950	1.0	0.2	950	1900	2.0	0.3	950
0.1	960	960	1.0	0.2	960	1920	2.0	0.3	960
0.1	970	970	1.0	0.2	970	1940	2.0	0.3	970
0.1	980	980	1.0	0.2	980	1960	2.0	0.3	980
0.1	990	990	1.0	0.2	990	1980	2.0	0.3	990
0.1	1000	1000	1.0	0.2	1000	2000	2.0	0.3	1000

CLASS SCORES

GRADE VII

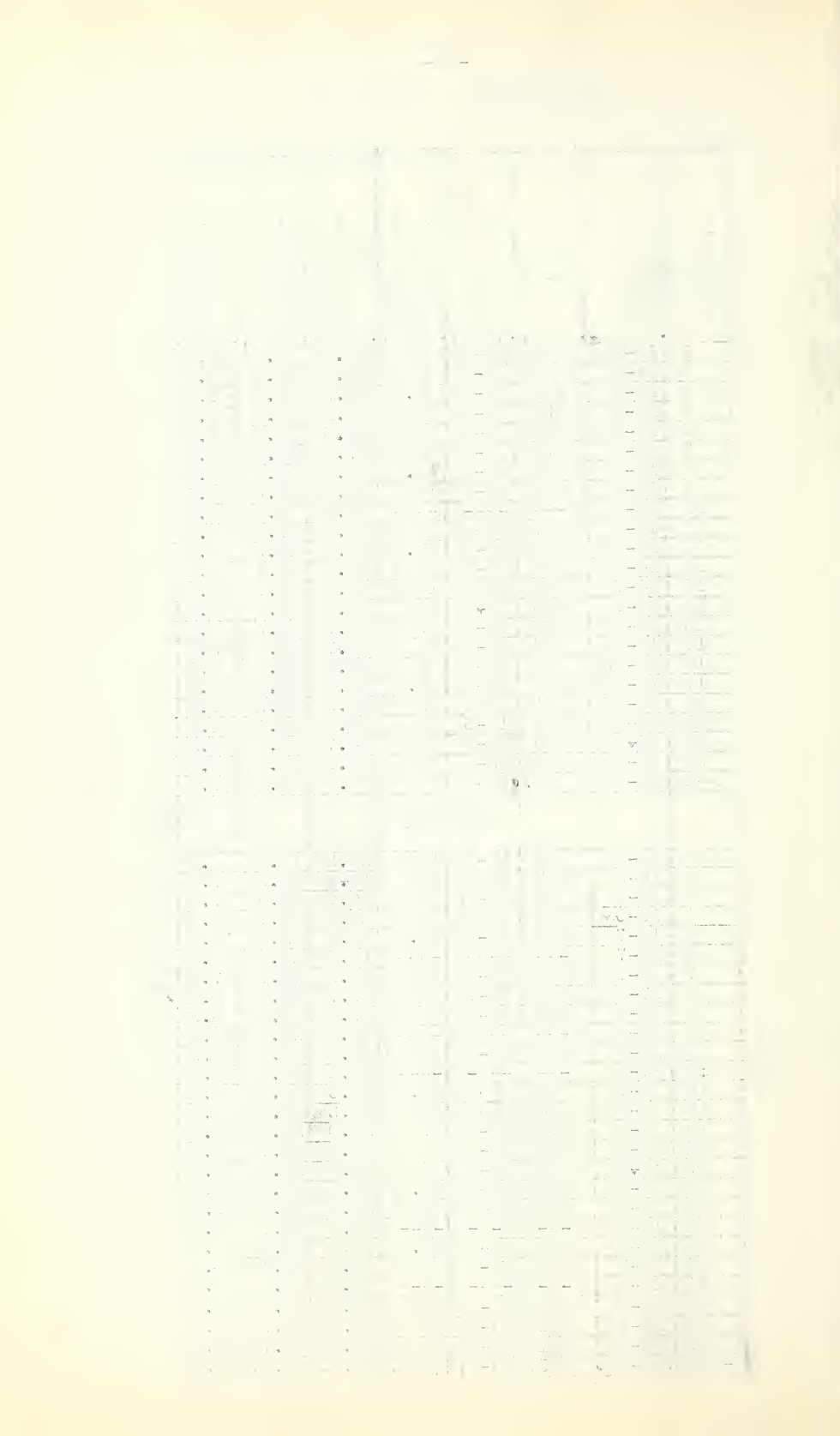
Student's Number	Average E. Score (S)	Rank in K Scores (H)	Rank in K. Scores (S)	Rank in E. Scores (H)	Rank in E. Scores (S)	Ratio K/E (H)	Ratio K/E (S)	Language Spoken At Home
1	14.0	9	8	29	36	1.56	1.42	Ital.
2	10.8	28	22	34	20.5	1.11	1.62	Fr.
3	9.6	13	19	8.5	11.5	1.84	1.95	Fr.
4	7.1	7	6	14	3	1.92	3.01	Eng.
5	13.4	20	27	25	35	1.38	1.27	Ital.
6	12.1	29	27	35	30	1.10	1.41	Eng.
7	9.7	24.5	21	18.5	13	1.45	1.81	Eng.
8	8.8	33	30	16.5	7	1.31	1.87	Ital.
9	13.1	22.5	23.5	21.5	34	1.42	1.32	Ital.
10	9.3	32.	29	8.5	10	1.44	1.81	Hung.
11	10.6	16	7	30.5	19	1.37	1.94	Boh.
12	5.8	27	10.5	7	2	1.63	2.86	Slav.
13	11.1	14.5	15.5	26.5	22.5	1.45	1.71	Slav.
14	11.4	8	23.5	24	25	1.66	1.51	Eng.
15	10.1	2	3.5	10	16	2.15	2.28	Eng.
16	10.2	3	3.5	6	17	2.21	2.26	Eng.
17	10.5	17.5	33	28	18	1.35	1.51	Eng.
18	11.1	6	14	11.5	22.5	2.00	1.72	Boh.
19	10.8	24.5	13	26.5	20.5	1.32	1.78	Eng.
20	9.9	30	25	11.5	15	1.50	1.73	Eng.
21	11.3	17.5	12	18.5	24	1.54	1.71	Eng.
22	9.2	14.5	15.5	15	9	1.68	2.06	Ital.
23	9.8	5	2	32	14	1.60	2.54	Eng.
24	11.5	26	10.5	21.5	26.5	1.38	1.69	Pol.
25	9.6	31	35	5	11.5	1.59	1.55	Eng.
26	9.0	4	5	3	8	2.64	2.40	Eng.
27	12.2	36	36	13	31	1.30	1.19	Eng.
28	7.6	1	1	1	4	4.33	3.38	Ukr.
29	8.1	10	20	16.5	6	1.78	2.30	Ukr.
30	11.5	12	9	23	26.4	1.55	1.73	Slav.
31	12.4	11	17.5	20	32	1.62	1.52	Ital.
32	5.1	19	34	2	1	2.54	3.00	Eng.
33	7.7	34.5	32	4	5	1.55	2.10	Eng.
34	12.8	22.5	27	33	33	1.26	1.33	Eng.
35	11.8	21	17.5	30.5	28	1.30	1.60	Ukr.
36	12.0	34.5	31	36	29	0.89	1.36	Eng.
37-36	10.3					1.58	1.84	





CLASS SCORES GRADE VIII

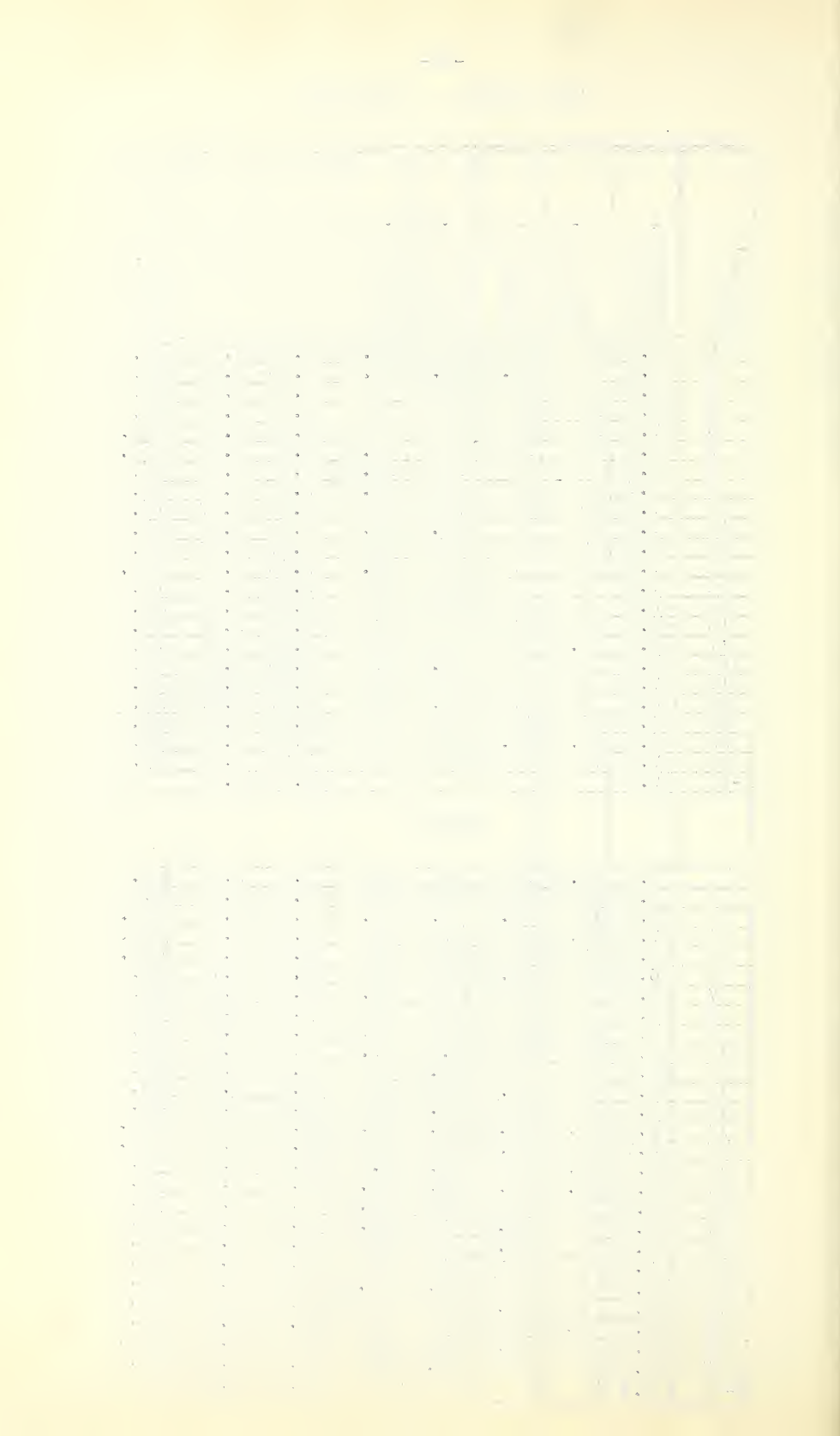
Student's Number	Chronological Age	I. Q.	Mental Age.	Rank in Mental Age	Average K. Score (H)	Average K. Score (S)	Average E. Score (H)
1	13-7	109	15-2	10	21.4	19.0	11.7
2	14-7	110	16-3	4	21.8	17.8	10.7
3	14-4	110	16-1	5.5	24.2	22.3	7.5
5	14-5	102	14-6	12	20.1	19.8	11.0
6	13-6	103	14-2	18	20.5	19.2	9.4
7	15-11	96	14-4	15	17.2	18.8	13.4
8	15-6	106	16-1	5.5	21.9	21.5	11.6
9	15-4	102	14-6	12	21.5	15.8	8.1
10	14-4	---	----	----	18.9	19.4	12.3
11	14-11	99	14-4	15	17.0	17.5	10.7
12	14-8	108	15-11	7.5	22.1	24.0	9.7
13	14-2	98	13-7	20	18.5	21.1	11.8
14	14-7	100	14-4	15	23.5	20.9	10.2
15	13-7	116	16-8	2	26.0	26.4	6.6
16	13-7	110	15-5	9	15.9	16.0	8.0
17	15-2	97	14-2	18	18.7	19.1	13.3
18	13-10	117	16-11	1	22.2	22.1	9.1
19	14-0	110	15-11	7.5	25.0	24.1	9.3
20	14-9	101	14-6	12	24.3	20.2	9.1
21	11-1	123	16-6	3	19.4	18.4	4.5
22	16-0	95	14-2	18	18.7	17.8	10.3
23	15-9	89	13-1	21	17.9	16.3	10.0
N-22	14-8	104.8	15-2		20.8	19.9	9.8
GRADE IX							
1	15-0	98	14-2	19	20.2	17.8	8.5
2	14-0	107	15-0	16	16.5	18.8	7.3
3	18-2	97	14-10	17	20.9	23.5	7.9
4	15-0	104	15-2	14	21.8	21.9	9.3
5	13-7	112	15-8	8.5	22.3	22.0	10.1
6	15-7	---	----	----	18.5	24.0	9.2
7	14-7	112	16-3	5	23.2	22.9	7.2
8	17-1	110	16-9	2	27.9	26.3	7.4
9	14-1	115	16-3	5	19.4	19.4	8.6
10	16-2	---	----	----	21.2	24.4	10.2
11	15-0	105	15-4	11	22.8	25.5	11.2
12	17-6	---	----	----	21.6	25.2	12.4
13	16-7	89	13-3	20.5	20.6	20.0	8.7
14	15-10	104	15-2	14	20.2	20.9	8.7
15	14-2	112	16-0	7	24.0	23.5	10.3
16	16-1	102	15-4	11	15.8	15.7	7.9
17	15-1	111	16-3	5	21.8	25.2	11.2
18	15-6	106	15-8	8.5	19.8	22.3	10.9
19	15-4	103	15-2	14	22.0	22.7	7.6
20	15-4	---	----	----	20.8	22.7	4.7
21	16-3	90	13-3	20.5	16.0	17.4	9.0
22	15-7	115	17-0	1	25.1	28.1	8.1
24	16-5	---	----	----	27.5	24.0	3.5
25	16-0	95	14-4	18	15.8	18.4	5.7
26	14-7	106	15-4	11	22.1	20.9	12.1
27	15-3	111	16-5	3	21.1	24.7	8.1
28	15-6	105	15-4		21.1	21.9	8.7





CLASS SCORES GRADE VIII

Student's Number	Average E. Score (S)	Rank in K. Scores (H)	Rank in K. Scores (S)	Rank in E. Scores (H)	Rank in E. Scores (S)	Ratio K/E (H)	Ratio K/E (S)	Language Spoken At Home.
1	9.9	11	14	18	18.5	1.82	1.91	Eng.
2	9.5	9	17.5	14.5	13.5	2.03	1.87	Eng.
3	6.3	4	4	3	3	3.22	3.54	Eng.
5	10.8	13	10	16	21	1.82	1.83	Eng.
6	7.9	12	12	9	7	2.18	2.43	Ital.
7	9.5	20	15	22	13.5	1.28	1.97	Slav.
8	9.5	8	6	17	13.5	1.88	2.26	Eng.
9	9.9	10	22	5	18.5	2.65	1.59	Eng.
10	9.8	15	11	20	18	1.54	1.97	BoH.
11	9.5	21	19	14.5	13.5	1.58	1.84	Ger.
12	9.0	7	3	10	11	2.27	2.66	Eng.
13	9.5	18	7	19	13.5	1.56	2.22	Ital.
14	9.2	5	8	12	12	2.30	2.27	Pol.
15	6.1	1	1	2	2	3.94	4.32	Eng.
16	6.7	22	21	4	4	1.98	2.38	Eng.
17	10.9	16.5	13	21	22	1.41	1.75	Boh.
18	8.7	6	5	6.5	9	2.45	2.54	Ukr.
19	7.5	2	2	8	5	2.68	3.21	Eng.
20	8.9	3	9	6.5	10	2.67	2.27	Eng.
21	4.5	14	16	1	1	4.31	4.08	Eng.
22	8.0	16.5	17.5	13	8	1.81	2.22	Eng.
23	7.7	19	20	11	6	1.79	2.11	Eng.
N-22	9.6					2.12	2.07	
GRADE IX								
1	7.8	18.5	24	13	22	2.4	2.3	Eng.
2	5.3	23	22	5	8	2.3	3.5	Fr.
3	5.2	15	10.5	8.5	5.5	2.6	4.5	Slav.
4	7.4	10.5	17	19	21	2.3	3.0	Ital.
5	9.0	7	16	20	25	2.2	2.4	Ital.
6	5.5	22	8.5	18	14	2.0	3.7	Eng.
7	5.2	5	12	4	5.5	3.2	4.4	Eng.
8	6.1	1	2	6	12	3.8	4.3	Eng.
9	5.1	21	21	14	3.5	2.3	3.8	Eng.
10	5.4	13	7	21	9.5	2.1	4.5	Eng.
11	5.7	6	3	24.5	11	2.0	4.5	Eng.
12	12.3	12	4.5	26	26	1.7	2.1	Ger.
13	6.9	17	20	15.5	18	2.4	2.9	Eng.
14	6.8	18.5	18.5	15.5	15.5	2.3	3.1	Slav.
15	8.7	4	10.5	22	24	2.3	2.7	Ital.
16	5.1	24.5	26	8.5	3.5	2.0	3.1	Eng.
17	6.8	10.5	4.5	24.5	15.5	1.9	3.7	Eng.
18	8.8	20	15	23	15.5	1.8	2.5	Pol.
19	5.2	9	13.5	7	5.5	2.9	4.4	Eng.
20	7.0	16	13.5	2	19	4.4	3.2	Eng.
21	7.2	26	25	17	20	1.8	2.4	Eng.
22	5.4	3	1	11.5	9.5	3.1	5.2	Eng.
24	5.0	2	8.5	1	2	7.9	4.8	Eng.
25	3.7	24.5	23	3	1	2.8	5.0	Ger.
26	8.0	8	18.5	25	23	1.8	2.6	Ital.
27	6.4	14	6	11.5	13	2.6	3.9	Eng.
N-26	6.6					2.4	3.3	



CLASS SCORES GRADE X

Student's Number	Chronological Age.	I. Q.	Mental Age	Rank in Mental Age	Average K. Score (H)	Average K. Score (S)	Average E. Score (H)
1	14-9	117	17-0	1	23.7	27.1	6.8
2	16-1	112	16-9	2	19.8	23.9	6.5
3	16-4	109	16-5	3	20.6	22.3	10.2
4	15-9	107	16-0	7	24.3	27.1	8.9
6	15-7	109	16-3	4	26.5	27.8	8.2
7	16-2	106	16-0	7	25.6	26.7	10.1
8	16-8	105	16-0	7	19.7	23.5	9.7
9	15-10	---	----	-	18.5	22.9	8.3
10	15-11	101	15-2	9	23.5	24.3	7.8
12	15-3	---	----	-	22.3	18.0	9.0
13	15-7	109	16-2	5	20.5	24.7	11.2
30	15-7	101	15-0	10	18.3	20.1	5.6
N- 12	15-10	107.6	16-1	--	21.9	24.0	8.5
GRADE XI							
14	17-5	103	15-10	11	24.1	25.7	8.4
15	16-4	117	17-6	2	29.3	30.7	5.7
16	15-10	120	17-9	1	26.9	29.4	6.0
17	16-8	116	17-3	3	26.5	26.7	6.8
18	17-2	102	15-8	12	21.8	24.3	9.4
19	16-9	108	16-5	8	28.8	29.4	7.2
20	17-11	104	16-0	10	29.2	32.5	7.5
21	16-9	102	15-6	13	22.2	27.7	9.0
22	17-7	112	17-0	4.5	26.3	26.9	4.8
23	16-1	100	15-0	14	24.4	27.9	8.0
24	16-8	107	16-3	9	26.5	26.0	4.7
25	15-6	111	16-9	7	28.2	28.3	5.8
26	17-9	89	10-5	15	32.1	25.4	9.0
27	19-6	---	----	--	21.7	21.4	7.4
28	16-2	114	17-0	4.5	27.1	31.5	7.4
29	16-3	113	16-10	6	24.4	26.6	6.0
N- 16	16-11	107.9	16-1	--	25.7	27.5	7.1

# THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first settlers, who came to the New World in search of a better life. They found a land of opportunity, but also a land of challenge. The early years were marked by conflict and struggle, as the settlers fought to establish a new society. Over time, the United States grew from a small colony into a powerful nation. It has faced many challenges, but it has always emerged stronger and more united than before.

The United States has a rich and diverse heritage. It is a land of many cultures, languages, and traditions. This diversity is one of its greatest strengths. It has allowed the United States to become a global leader in many fields, including science, technology, and the arts. The United States has also been a pioneer in the field of human rights, and it has played a leading role in the promotion of peace and justice around the world.

CLASS SCORES GRADE X

Student's Number	Average E. Score (S)	Rank in K. Scores (H)	Rank in K. Scores (S)	Rank in E. Scores (H)	Rank in E. Scores (S)	Ratio K/E (H)	Ratio K/E (S)	Language Spoken At Home.
1	4.4	4	2.5	3	3	3.5	6.2	Ital.
2	4.9	9	7	2	4	3.0	4.9	Ger.
3	9.1	7	10	11	12	2.0	2.5	Eng.
4	8.0	3	2.5	7	11	2.7	3.4	Eng.
6	6.6	1	1	5	7	3.2	4.2	Eng.
7	7.2	2	4	10	9	2.5	3.7	Ger.
8	7.0	10	8	9	8	2.0	3.4	Eng.
9	6.1	11	9	6	5	2.2	3.8	Eng.
10	7.3	5	6	4	10	3.0	3.3	Eng.
12	2.7	6	12	8	1	2.5	6.7	Eng.
13	6.5	8	5	12	6	1.8	3.8	Eng.
30	4.0	12	11	1	2	3.3	5.0	Finn.
N- 12	6.2					2.6	3.9	
GRADE XI								
14	6.2	12	13	13	15	2.9	4.1	Ital.
15	3.7	1	3	3	4	5.1	8.3	Eng.
16	3.6	6	4.5	5.5	3	4.5	8.2	Fr.
17	4.3	7.5	10	7	6	3.9	6.2	Eng.
18	6.5	15	15	16	16	2.3	3.7	Eng.
19	4.5	3	4.5	8	7	4.0	6.5	Ital.
20	5.3	2	1	11	10	3.9	6.1	Eng.
21	5.7	13	8	14.5	13	2.5	4.9	Eng.
22	3.1	9	9	2	2	5.5	8.7	Eng.
23	5.5	10.5	7	12	11	3.1	5.1	Eng.
24	4.2	7.5	12	1	5	5.6	6.9	Eng.
25	3.0	4	6	4	1	4.9	9.4	Ital.
26	5.6	14	14	14.5	12	2.5	4.5	Eng.
27	6.0	16	16	9.5	14	2.9	3.6	Eng.
28	4.9	5	2	9.5	9	3.7	6.4	Eng.
29	4.7	10.5	11	5.5	8	4.1	5.7	Eng.
N- 16	4.8					3.6	5.8	





CLASS SCORES GRADE XII

Student's Number	Chronological Age	I. Q.	Mental Age	Rank in Mental Age	Average I. Score (H)	Average A. Score (S)	Average E. Score (H)
1	20-9				25.2	27.0	7.2
2	22-4	107	16-5	12.5	25.7	31.5	7.7
3	18-10	114	17-3	5.5	25.6	27.0	7.1
4	17-10	114	17-3	5.5	27.6	28.3	5.2
5	17-8	116	17-6	4	31.2	32.7	6.0
6	17-2	99	15-2	16	22.3	22.7	7.0
7	17-5	110	16-9	9	22.9	24.4	5.8
8	16-7	130	18-11	1	28.9	28.8	5.0
9	18-11	119	17-11	3	23.2	30.6	8.6
10	17-8	108	16-6	10.5	24.1	24.8	6.5
11	17-9	95	14-6	18.5	23.5	26.1	9.2
12	20-4	107	16-5	12.5	26.0	28.4	6.2
13	17-4	---	---	---	24.3	29.2	5.7
14	17-7	108	16-6	10.5	24.5	24.2	6.8
15	19-10	---	---	---	24.2	29.7	6.2
16	19-10	111	16-10	8	26.5	26.8	6.3
17	18-3	96	14-8	17	24.2	27.3	9.1
18	18-8	112	17-0	7	30.2	28.3	6.3
19	18-6	104	16-0	14	26.2	26.7	6.9
20	17-4	122	18-3	2	28.4	29.6	6.7
21	18-5	100	15-4	15	22.9	24.8	8.1
22	17-11	95	14-6	18.5	22.5	26.6	6.6
22-22	18-6	108.	16-6		25.5	27.5	6.9





CLASS SCORES GRADE XII

Student's Number	Average E. Score (S)	Rank in L. Scores (H)	Rank in L. Scores (S)	Rank in E. Scores (H)	Rank in E. Scores (S)	Ratio L/E (H)	Ratio L/E (S)	Language Spoken at home.
1	5.3	11	12.5	17	14	3.5	5.1	Eng.
2	4.5	9	2	18	8.5	3.3	7.0	Ger.
3	5.1	10	12.5	16	12	3.6	5.3	Eng.
4	4.1	5	9.5	2	5	5.3	6.9	Eng.
5	3.9	1	1	5	4	5.2	8.4	Eng.
6	5.8	22	22	15	20	3.2	3.9	Ital.
7	5	19.5	20	4	11	3.9	4.9	Eng.
8	4.3	3	7	1	7	5.8	6.7	Eng.
9	3.6	18	3	20	3	2.7	8.5	Eng.
10	4.6	16	18.5	10	10	3.7	5.4	Ukr.
11	5.6	17	17	22	17	2.6	4.7	Hung.
12	3.3	8	8	6.5	2	4.2	8.6	Eng.
13	2.5	13	6	3	1	4.3	11.6	Ukr.
14	5.4	12	21	13	15.5	3.6	4.5	Eng.
15	4.5	14.5	4	6.5	8.5	3.9	6.6	Eng.
16	4.2	6	14	8.5	6	4.2	6.4	Eng.
17	6.6	14.5	11	21	22	2.7	4.1	Eng.
18	5.4	2	9.5	8.5	15.5	4.8	5.2	Eng.
19	5.7	7	15	14	18.5	3.8	4.7	Ukr.
20	6	4	5	12	21	4.2	4.9	Ukr.
21	5.2	19.5	18.5	19	13	2.8	4.8	Ger.
22	5.7	21	16	11	18.5	3.4	4.7	Eng.
1-22	4.8					3.7	5.7	

Date		Description		Amount	
1890	Jan 1	Balance		100.00	
	Feb 1	Interest		1.00	
	Mar 1	Interest		1.00	
	Apr 1	Interest		1.00	
	May 1	Interest		1.00	
	Jun 1	Interest		1.00	
	Jul 1	Interest		1.00	
	Aug 1	Interest		1.00	
	Sep 1	Interest		1.00	
	Oct 1	Interest		1.00	
	Nov 1	Interest		1.00	
	Dec 1	Interest		1.00	
1891	Jan 1	Balance		100.00	
	Feb 1	Interest		1.00	
	Mar 1	Interest		1.00	
	Apr 1	Interest		1.00	
	May 1	Interest		1.00	
	Jun 1	Interest		1.00	
	Jul 1	Interest		1.00	
	Aug 1	Interest		1.00	
	Sep 1	Interest		1.00	
	Oct 1	Interest		1.00	
	Nov 1	Interest		1.00	
	Dec 1	Interest		1.00	
1892	Jan 1	Balance		100.00	
	Feb 1	Interest		1.00	
	Mar 1	Interest		1.00	
	Apr 1	Interest		1.00	
	May 1	Interest		1.00	
	Jun 1	Interest		1.00	
	Jul 1	Interest		1.00	
	Aug 1	Interest		1.00	
	Sep 1	Interest		1.00	
	Oct 1	Interest		1.00	
	Nov 1	Interest		1.00	
	Dec 1	Interest		1.00	

CHAPTER IV  
ANALYSIS OF DATA  
Correlations

The following table was calculated from Pearson's formula for rank correlations.

TABLE I  
A TABLE OF CORRELATIONS.

Rankings	Grades						
Correlated	VI	VII	VIII	IX	X	XI	XII
M.A. and K(H)	.45	.51	.58	.42	.02	.64	.49
M.A. and K(S)	.27	.38	.49	.40	.24	.49	.42
M.A. and E(H)	.62	.28	.53	.02	-.46	.72	.39
M.A. and E(S)	.31	.22	.37	-.24	-.13	.75	.36
K(H) and K(S)	.72	.77	.75	.70	.76	.89	.57
E(H) and E(S)	.81	.70	.78	.73	.50	.91	.55
K(H) and E(H)	-.11	-.10	.48	-.01	-.16	.61	.45
K(S) and E(S)	-.26	.13	.24	-.18	-.34	.52	.53

Explanation of abbreviations:

- M.A.--Mental Age.
- K.--Knowledge Scores.
- E.--Error Scores.
- H.--Tests on words chosen from History.
- S.--Tests on words chosen from Science.

Rankings were arranged in each grade as follows:

- M.A.---Highest to lowest.
- K.---Highest to lowest.
- E.---Lowest to highest.

According to the rankings, a positive correlation for E. and M.A. or E. and K. indicates that E. decreases as M.A. or K. increases. Where K. is correlated in the table with any variable except E., a positive correlation indicates that the two variables increase or decrease together.

The Knowledge Scores

The knowledge scores have been classified in three ways. Firstly, the mean knowledge score for each grade was determined by taking the sum of the mean knowledge scores of the individual pupils in each grade and dividing this sum by the number of pupils in the grade. Secondly, the students were grouped according to chronological age, at age intervals of six months, and the mean score of each group determined. Finally, students were arranged in mental age groups, also at six months intervals, and

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

the mean scores of each group recorded. The tables and graphs of these results are given here.

TABLE II

GROWTH OF KNOWLEDGE BY GRADES

Grade	VI	VII	VIII	IX	X	XI	XII
No. of Students	32	36	22	26	12	16	22
K. Scores (Hist.)	13.9	19.0	20.8	21.1	21.9	25.7	25.5
K. Scores (Sc.)	13.7	19.0	19.9	21.9	24.0	27.5	27.5

TABLE III

GROWTH OF KNOWLEDGE BY CHRONOLOGICAL AGE

Chronological Age Intervals Years & Months	No. of Students	Mean Knowledge Score History	Mean Knowledge Score Science.
11.0---11.5	4	16.9	15.1
11.6---11.11	4	14.8	14.9
12.0---12.5	9	15.8	16.2
12.6---12.11	19	17.2	16.8
13.0---13.5	10	17.8	17.9
13.6---13.11	15	17.5	17.3
14.0---14.5	13	20.6	20.4
14.6---14.11	16	19.4	18.8
15.0---15.5	13	20.1	19.9
15.6---15.11	14	21.9	24.0
16.0---16.5	12	23.2	24.9
16.6---16.11	5	24.9	25.5
17.0---17.5	8	23.5	25.0
17.6---17.11	11	25.0	27.3
18.0---18.5	3	22.7	25.2
18.6---18.11	4	26.3	28.1
19.0---19.5	--	---	---
19.6---19.11	3	24.1	26.0
20.0---20.5	1	26.0	28.4
20.6---20.11	1	25.2	27.0

TABLE IV

GROWTH OF KNOWLEDGE BY MENTAL AGE GROUPS

Mental age Intervals Years & Mo.	No. of Students	Mean Knowledge Scores History	Mean Knowledge Scores Science.
10.0---10.5	3	12.6	12.9
10.6---10.11	2	14.0	16.0
11.0---11.5	5	14.6	13.7
11.6---11.11	4	18.0	17.9
12.0---12.5	10	15.2	15.1
12.6---12.11	13	15.2	15.8
13.0---13.5	13	17.4	17.1
13.6---13.11	8	19.4	19.7
14.0---14.5	12	18.8	18.2
14.6---14.11	10	20.3	20.2
15.0---15.5	16	20.8	21.3
15.6---15.11	8	23.2	24.5
16.0---16.5	20	23.9	25.2
16.6---16.11	11	24.2	24.7
17.0---17.5	8	26.5	28.0
17.6---17.11	4	27.7	30.9
18.0---18.5	1	28.4	29.6
18.6---18.11	1	28.9	28.8



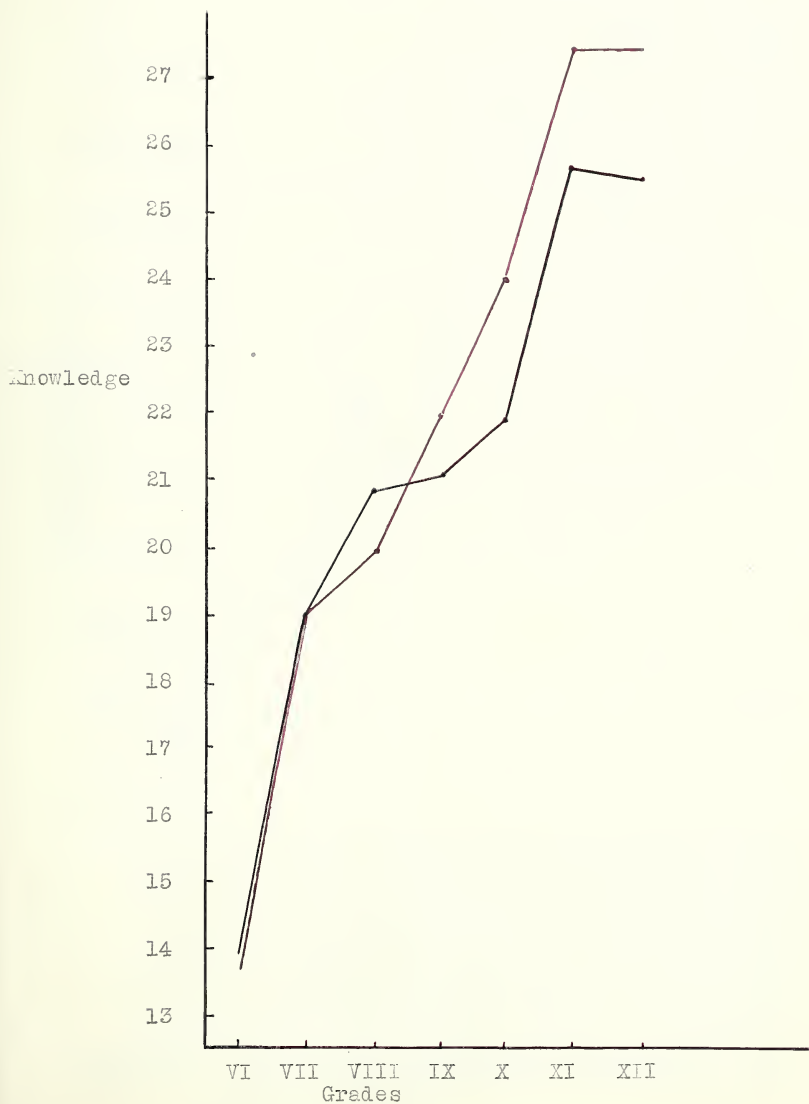


Figure 1.- Growth of knowledge by grades.

Black -- History  
Red -- Science







Figure 2.- Growth of knowledge by chronological age.

Black -- History  
Red -- Science



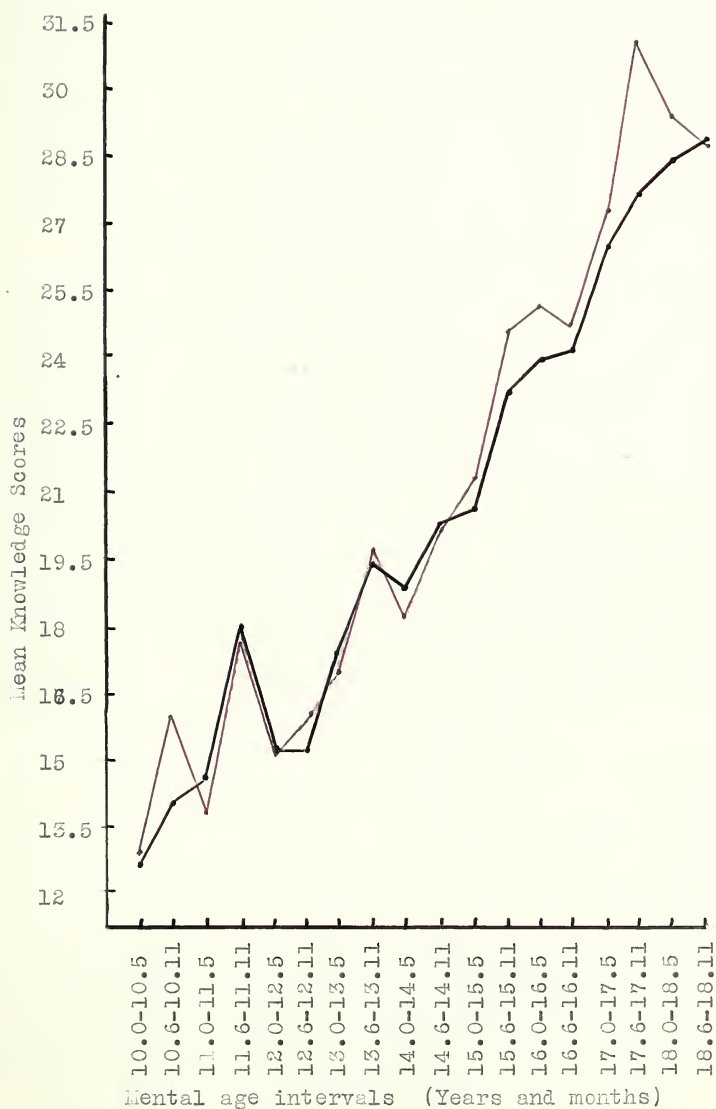


Figure 3.- Growth of knowledge by mental age.

Black -- History.  
Red -- Science.



The increase in knowledge score by grades is most noticeable as between grades VI and VII. From grade VII to grade XI there is also a fairly steep rise in the knowledge score. Grade XII show exactly the same mean score as grade XI. In interpreting these scores it is necessary to consider the possible effects on the score of the smaller sampling of students in the higher grades and the variability of grades with regard to mental ability and industry. As an instance, the grade XI class which wrote these tests were above average in mental power while the grade XII class were somewhat below average in this respect.

Increase of knowledge by chronological age is almost uniform up to the age of seventeen. From there on the rate of increase lessens. The explanation might be that students in the higher chronological age groups are those of less ability who are repeating work in the higher grades. The erratic nature of the development is probably owing to the small sampling in some of the age intervals, especially at the upper levels.

Growth of knowledge and increase of mental age shows a higher correlation than growth of knowledge by grade or by chronological age. There is apparently no slowing down in growth of knowledge at the higher mental age levels as was observable at higher grade and chronological age levels.

The knowledge score on these tests is obviously subject to the element of guessing. In order to determine the scores which would be made by students having little or no knowledge of the words, five of the tests were given this term to grades IV and V under same conditions and with same instructions given to the higher grades. The following table shows the results of these tests.

TABLE IVA.

Grade	IV	V
Mean Knowledge Score	12.1	16.6
Mean Error Score	12.4	12.3
Knowledge--Error Ratio	.98	1.4



This table shows that students who are merely guessing are able to make a considerable knowledge score. The children in grade IV were questioned orally about the words before writing the tests and in almost all cases professed to have no knowledge of the words. It is observable that the mean knowledge score in grade IV is practically the same as the mean error score. An examination of the answers given by grade IV students revealed that no students were able to define the words or to use them correctly in sentences. Further oral questioning of the children of this grade by their own teacher failed to discover the existence of any actual knowledge of the words.

Just how much of the knowledge score made in the different grades is actual knowledge and how much could result from guessing? In grade IV there was no actual knowledge and we note that K-E was equal to zero. Grade V children who claimed to have some knowledge of the words made a mean knowledge score in excess of their mean error score. Allowing an equal number of points for guessing in knowledge and in error scores and subtracting the error score from the knowledge score, we would have left the minimum knowledge content of the knowledge score. If the scores contain no element of guessing, the whole knowledge score represents actual knowledge. This means the range of actual knowledge lies between K-E and K. For the different grades this range is as shown in the following table.

TABLE IVB.

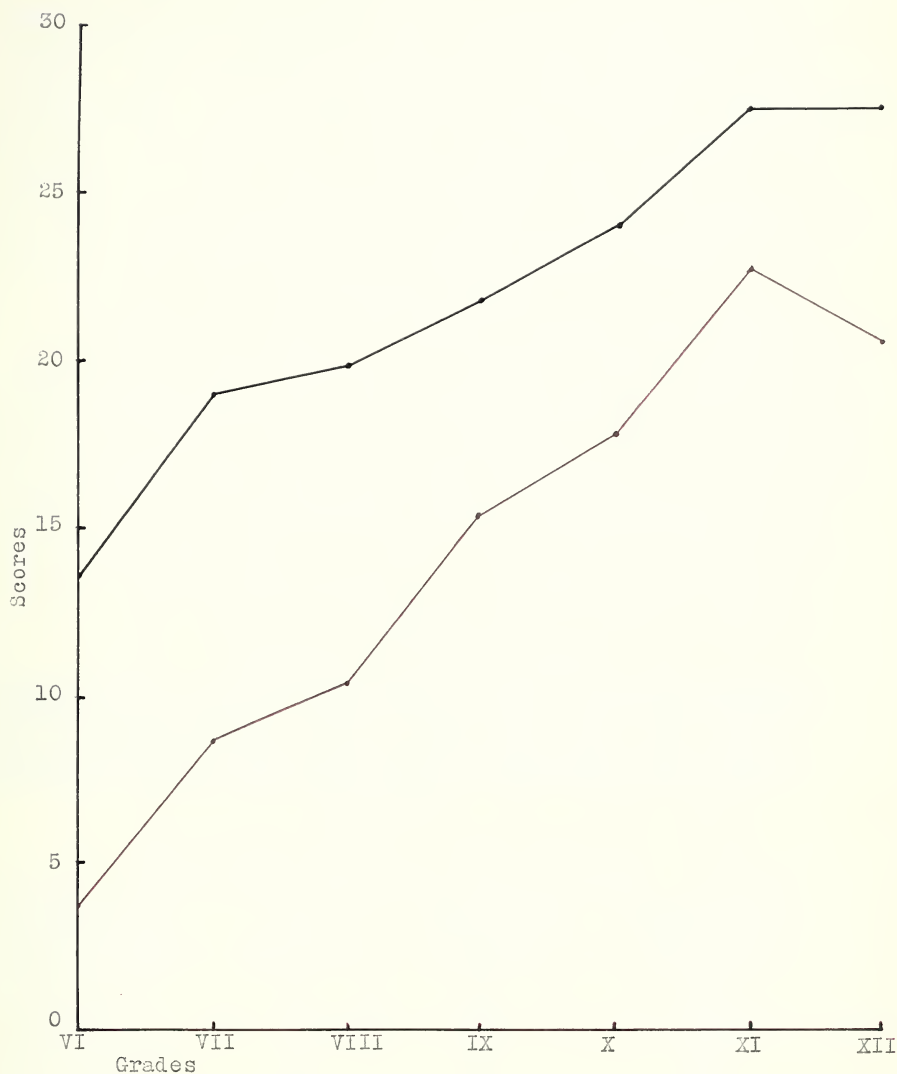
SHOWING PROBABLE RANGE OF ACTUAL KNOWLEDGE

Grade	VI	VII	VIII	IX	X	XI	XII
K Score (S)	13.7	19.0	19.9	21.9	24.0	27.5	27.5
E Score (S)	9.9	10.3	9.6	6.6	6.2	4.8	6.9
K-E Score (S)	3.8	8.7	10.3	15.3	17.8	22.7	20.6
K Score (H)	13.9	19.0	20.8	21.1	21.9	25.7	25.5
E Score (H)	11.8	12.0	9.8	8.7	8.5	7.1	6.9
K-E Score (H)	2.1	7.0	11.0	12.4	13.4	18.6	18.6

Still allowing equal points for guessing in the knowledge and error scores, it is obvious that the part of the knowledge score which results from guessing could not exceed the error score.







Black--K. Score  
Red--(K-E) Score

Figure 4.- Showing probable range of actual knowledge.

The students' actual knowledge lies between the two lines shown in the figure.



Tables 4, 5, and 6 show that the mean error score decreases as grades, chronological age and mental age increase. This means the possible range of guessing is narrowing at upper grade and age levels. It follows that the knowledge score at these higher grade and age levels is more and more indicative of actual knowledge and that at lower grade and age levels the reverse is true. Hence it is probable that the rate of increase in actual knowledge is greater than rate of increase shown by the knowledge scores.

#### THE ERROR SCORES

It has been the aim of these tests to discover as nearly as possible the student's concept of words. To do this allowance has been made for the erroneous ideas connected with words by scoring separately. Error scores have been classified in the same three ways as the knowledge scores. Tables and graphs dealing with these scores follow.

TABLE V

#### DECREASE OF ERROR BY GRADES

Grade	VI	VII	VIII	IX	X	XI	XII
No. of Students	32	36	22	26	12	15	22
E Scores (Hist.)	11.8	12.0	9.7	8.7	8.5	7.1	6.9
E Scores Science	9.9	10.3	9.6	6.6	6.2	4.8	4.8

TABLE VI

#### DECREASE OF ERROR BY CHRONOLOGICAL AGE

Chronological Age Intervals Years & Months	Number of Students	Mean Error Score (history)	Mean Error Score (Science)
11.0---11.5	4	9.9	8.8
11.6---11.11	4	10	8.9
12.0---12.5	9	12.7	10.5
12.6---12.11	19	11.2	9.5
13.0---13.5	10	11	9.7
13.6---13.11	15	11.1	9.2
14.0---14.5	13	11.3	9.6
14.6---14.11	16	11	9.1
15.0---15.5	13	9.8	7.9
15.6---15.11	14	8.9	6.6
16.0---16.5	12	7.3	5.3
16.6---16.11	5	7.1	5.4
17.0---17.5	8	7.4	5.7
17.6---17.11	11	7.5	5.6
18.0---18.5	3	8.4	5.7
18.6---18.11	4	7.2	5.0
19.0---19.5	--	--	--
19.6---19.11	3	6.6	4.9
20.0---20.5	1	6.2	3.3
20.6---20.11	1	7.2	5.3



TABLE VII

DECREASE IN ERROR BY MENTAL AGE GROUPS

Mental Age Intervals Years & Months	Number of Students	Mean Error Scores in History Tests	Mean Error Scores in Science Tests.
10.0---10.5	3	13.5	11.8
10.6---10.11	2	16.3	12.6
11.0---11.5	5	13.6	12.4
11.6---11.11	4	12.9	11.4
12.0---12.5	10	11.7	10.3
12.6---12.11	13	11.7	9.5
13.0---13.5	13	10.6	8.7
13.6---13.11	8	11.5	9.5
14.0---14.5	12	10.7	9.4
14.6---14.11	10	8.7	7.0
15.0---15.5	16	9.0	6.9
15.6---15.11	8	9.2	7.5
16.0---16.5	20	8.7	6.5
16.6---16.11	11	6.5	5.2
17.0---17.5	8	6.6	4.6
17.6---17.11	4	6.6	3.7
18.0---18.5	1	6.7	6.0
18.5---18.11	1	5.0	4.3



Figure 4b.-Decrease of error scores by grades.  
Red--Science                      Black--History

1. The first of these is the

2. The second of these is the

3. The third of these is the

4. The fourth of these is the



Figure 5.- Decrease of error by chronological age.

Black -- History  
Red -- Science

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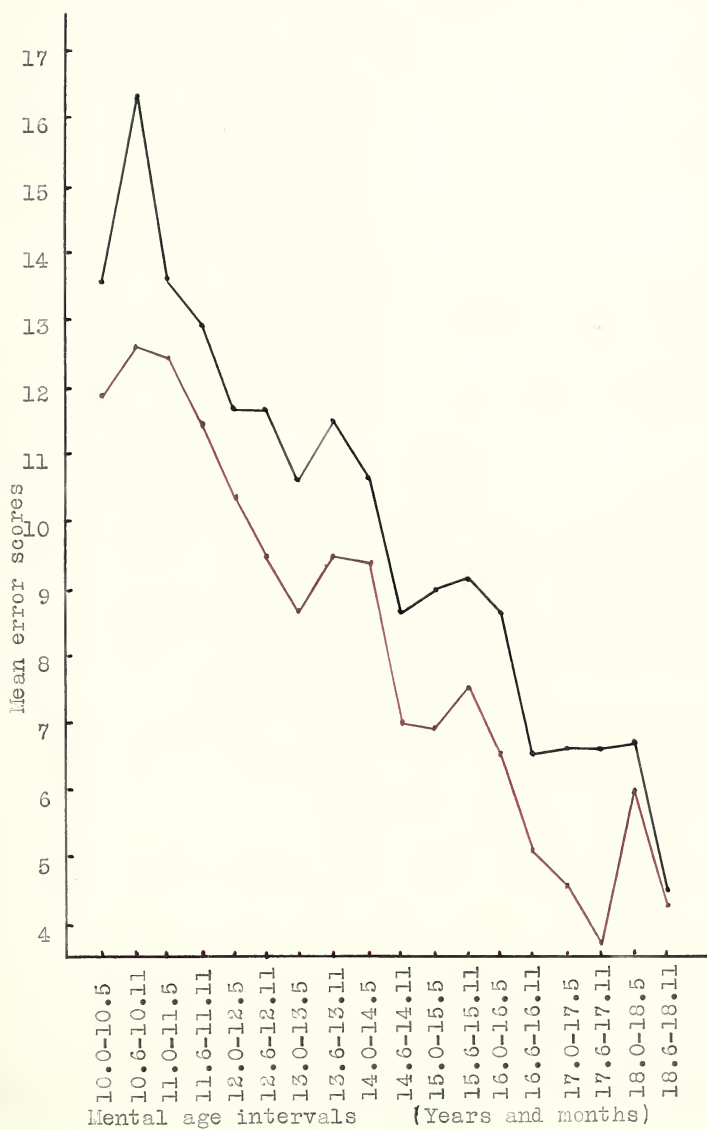


Figure 6.- Decrease of error by mental age.

Black -- History  
Red -- Science

— — — — —  
— — — — —

Decrease in error by grades is practically uniform from grades VII to grade XII. The slight increase in error from grade VI to grade VII may result from Grade VII students attempting more questions than grade VI students. In grade VI the mean knowledge score plus the mean error score was 23.6 while in grade VII the sum of the same two scores was 29.3. Evidently grade VII students, on the average, tried for 5.7 more points than grade VI students. The 0.4 points of error increase in grade VII could arise through the element of guessing entering in their attempt for the 5.7 additional points. Grade VII actually tried for more points than grade IX.

The increase in errors in the lower age intervals, chronological and mental, may have a similar explanation. Decrease in error by mental age seems somewhat more steady than decrease in error by chronological age.

These error scores include actual error and guessing. Decrease in error scores probably shows decrease in both actual error and guessing. It is not inherent in these tests to measure actual knowledge or actual error apart from the element of guessing.

#### THE KNOWLEDGE ERROR RATIO

In discussing the knowledge scores it was pointed out that owing to the element of guessing, the increase in the knowledge score may not give a very accurate picture of actual knowledge increase. Suppose a student has a knowledge score of 15 and an error score of 11, there are only 4 points out of the 15 points for knowledge which are certain to reflect actual knowledge. Now if a student of the next higher grade has a score of 20 for knowledge and 8 for error, there are 12 certain points for knowledge present. Evidently the increase in actual knowledge could be 300 per cent but considering only the recorded knowledge scores, the advance from 15 to 20 is only  $33 \frac{1}{3}\%$ . Now if in each case we divide the knowledge score by the corresponding error score, the knowledge--error ratio is in the first case 1.36 and in the second case 2.5, an increase of over 80%. Obviously the increase



in this knowledge--error ratio is a better approximation to the truth concerning growth in actual knowledge than the increase in the bare knowledge scores. The data show that knowledge scores increase and error scores decrease. From this it follows that the increase in K/E is a combined effect of these two tendencies. Also decreasing error scores indicate decrease in the element of guessing as well as decrease in actual error. Hence the tendency of the K/E ratio to increase points to a greater accuracy of word concepts. The mean knowledge--error ratios have been worked out for the different grades, and for chronological and mental age groups. The results are shown in the following tables and graphs.

TABLE VIII

RATIO OF MEAN KNOWLEDGE SCORES TO MEAN ERROR  
SCORES BY GRADES.

Grade	VI	VII	VIII	IX	X	XI	XII
No. of Students	32	36	22	26	12	16	22
Ratio K/E (Hist)	1.17	1.38	2.12	2.4	2.6	3.6	3.7
Ratio K/E (Sc.)	1.38	1.84	2.07	3.3	3.9	5.8	5.7

TABLE IX

RATIO OF MEAN KNOWLEDGE SCORES TO MEAN  
ERROR SCORES BY CHRONOLOGICAL AGE.

Chronological Age Intervals Years & Months	Number of Students	Ratio K/E History.	Ratio K/E Science.
11.0---11.5	4	2.1	2.1
11.6---11.11	4	1.5	1.8
12.0---12.5	9	1.4	1.7
12.6---12.11	19	1.6	1.9
13.0---13.5	10	1.7	2.0
13.6---13.11	15	1.7	2.1
14.0---14.5	13	1.9	2.3
14.6---14.11	16	1.9	2.3
15.0---15.5	13	2.2	3.0
15.6---15.11	14	2.7	4.2
16.0---16.5	12	3.5	5.0
16.6---16.11	5	4.0	5.3
17.0---17.5	8	3.3	5.0
17.6---17.11	11	3.6	5.5
18.0---18.5	3	2.7	4.5
18.6---18.11	4	3.7	5.9
19.0---19.5	-	---	---
19.6---19.11	3	3.7	5.5
20.0---20.5	1	4.2	8.6
20.6---20.11	1	3.5	5.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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TABLE X.

RATIO OF MEAN KNOWLEDGE SCORES TO MEAN ERROR  
SCORES BY MENTAL AGE

Mental age intervals. Years & Months	Number of Students	Ratio of Knowledge Scores to Error Scores (History)	Ratio K/E. Science.
10.0---10.5	3	1.0	1.1
10.6---10.11	2	0.9	1.3
11.0---11.5	5	1.1	1.3
11.6---11.11	4	1.4	1.6
12.0---12.5	10	1.3	1.5
12.6---12.11	13	1.3	1.7
13.0---13.5	13	1.7	2.1
13.6---13.11	8	1.7	2.1
14.0---14.5	12	1.9	2.2
14.6---14.11	10	2.4	3.2
15.0---15.5	16	2.4	3.4
15.6---15.11	8	2.6	3.4
16.0---16.5	20	2.9	4.4
16.6---16.11	11	3.8	5.1
17.0---17.5	8	4.2	6.3
17.6---17.11	4	4.4	8.5
18.0---18.5	1	4.2	4.9
18.6---18.11	1	5.8	6.7

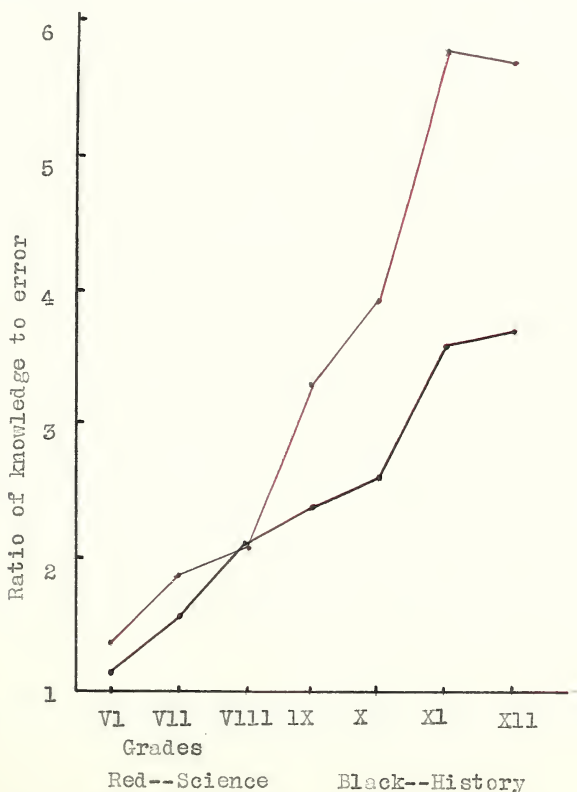
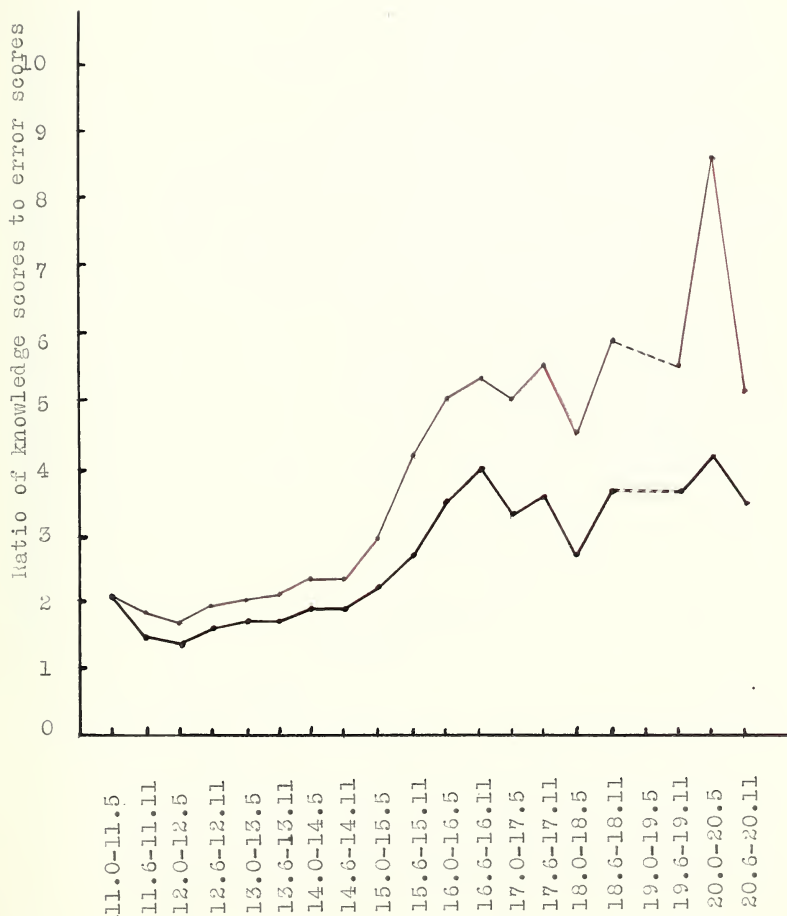


Figure 7.-Ratio of mean knowledge scores to mean error scores for each grade.







Chronological age intervals (Years and months)

Red--Science

Black--History

Figure 8.- Ratio of mean knowledge scores to mean error scores by chronological age.



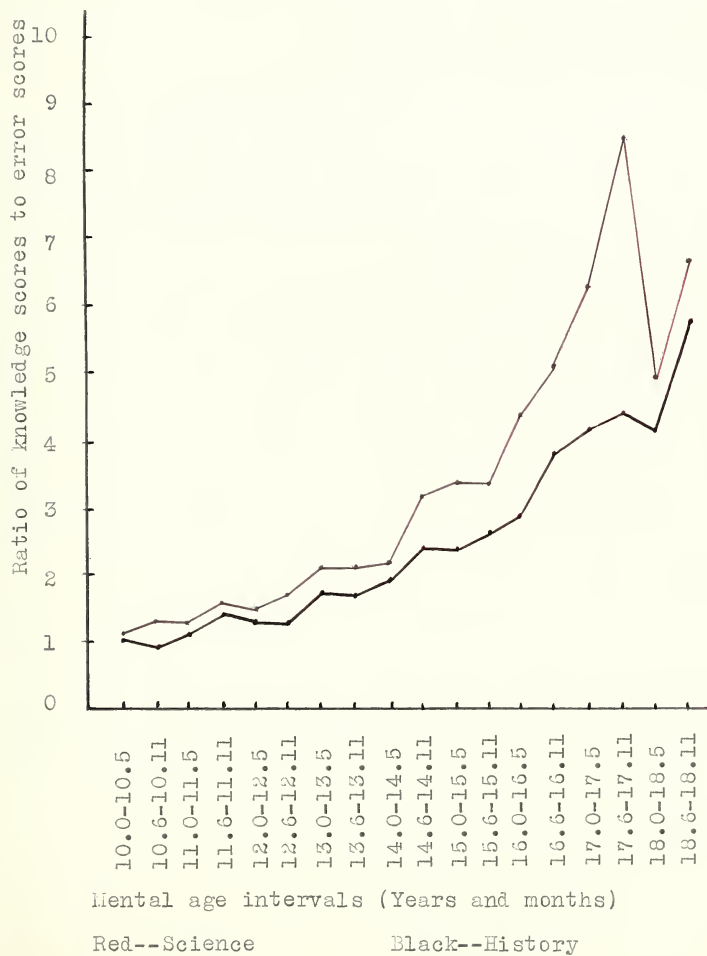
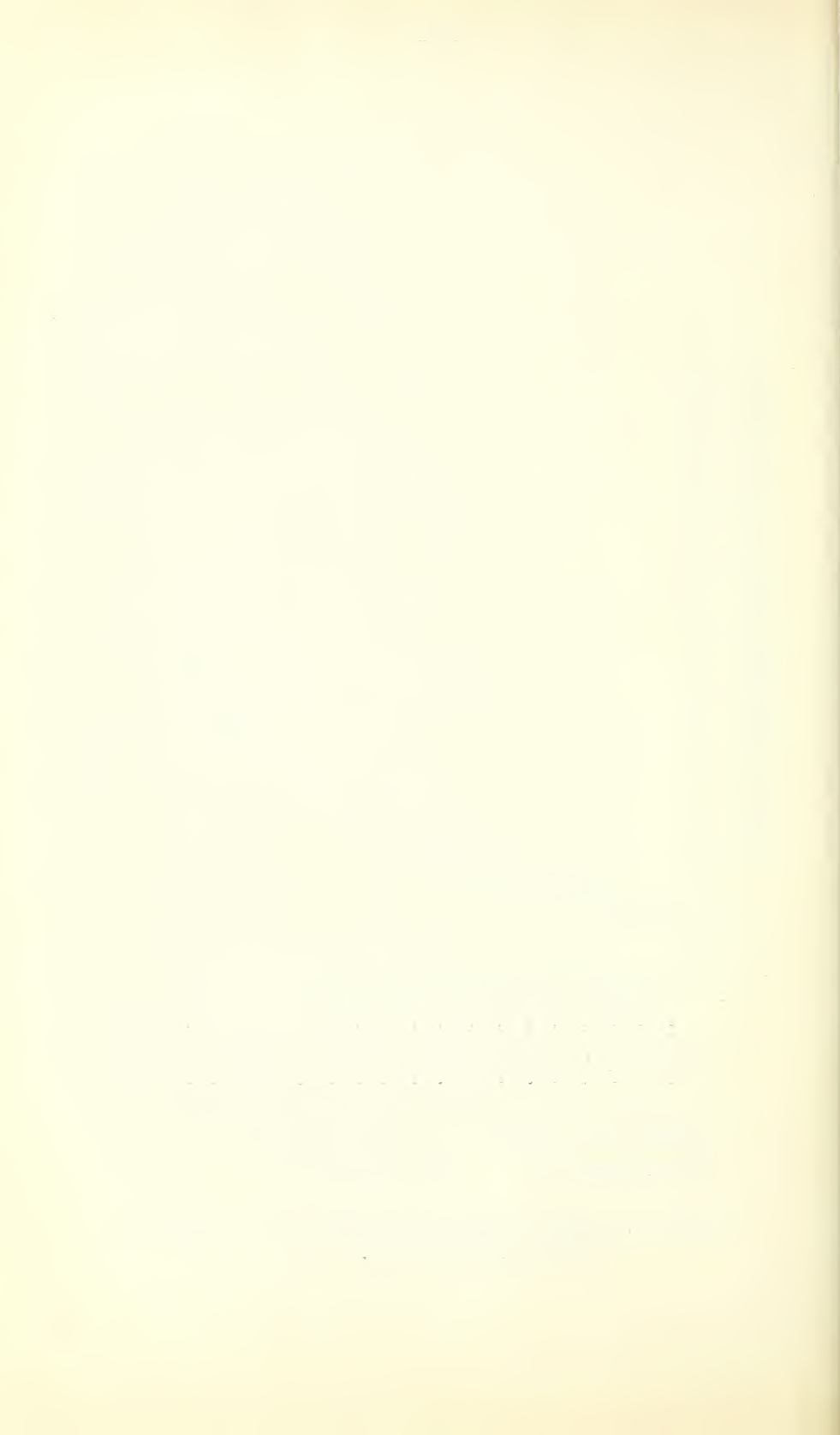


Figure 9.- Ratio of mean knowledge scores to mean error scores by mental age.



From grades VI to VIII the increase in  $K/E$  is gradual. At the grade IX level there is a sharp increase and this is maintained up to grade XI. Grade XII shows a drop in  $K/E$  as compared with grade XI. There is a similar tendency in the behavior of  $K/E$  in relation to increase in chronological age and mental age increases. This suggests that  $K/E$  is a power function of mental age, which would indicate that accuracy of knowledge is more closely related to mental age than to grades or chronological age.

A considerable degree of reliability of the preceding results is indicated by the general agreement in the results obtained by Mr. McEachern and myself. It is observable that in general for the same groups the scores rise and fall together and in very many cases at approximately the same rates. Since the same students have shown such uniformity in scores on these two sets of tests, it would seem that these tests are measuring the same qualities and are doing so fairly reliably. The fact that the two tests were on different types of words, were not identical in structure and were scored by different people increases the significance of the correspondence in results.

At the grade IX level the science scores begin to diverge from the history scores. The interpretation of this seems to be that the formal teaching of science in High School places more emphasis on a definite knowledge of words than the formal teaching of history does.



CHAPTER V

A MORE DETAILED QUALITATIVE ANALYSIS

Correct usage of words.

The second question on every test asked the student to use the test word in a sentence in such a way as to show an understanding of the meaning of the word. The following table and graph shows the mean scores made by the different grades on this question.

TABLE XI

PERCENTAGE OF STUDENTS IN EACH GRADE WHO WERE  
ABLE TO USE THE WORDS CORRECTLY IN SENTENCES.

Grade	VI	VII	VIII	IX	X	XI	XII
Possible Uses	343	388	231	254	124	162	208
Used Correctly	156	267	178	219	116	154	196
Percentage Rt.	45.5	68.8	77	86.2	93.5	95	94.2

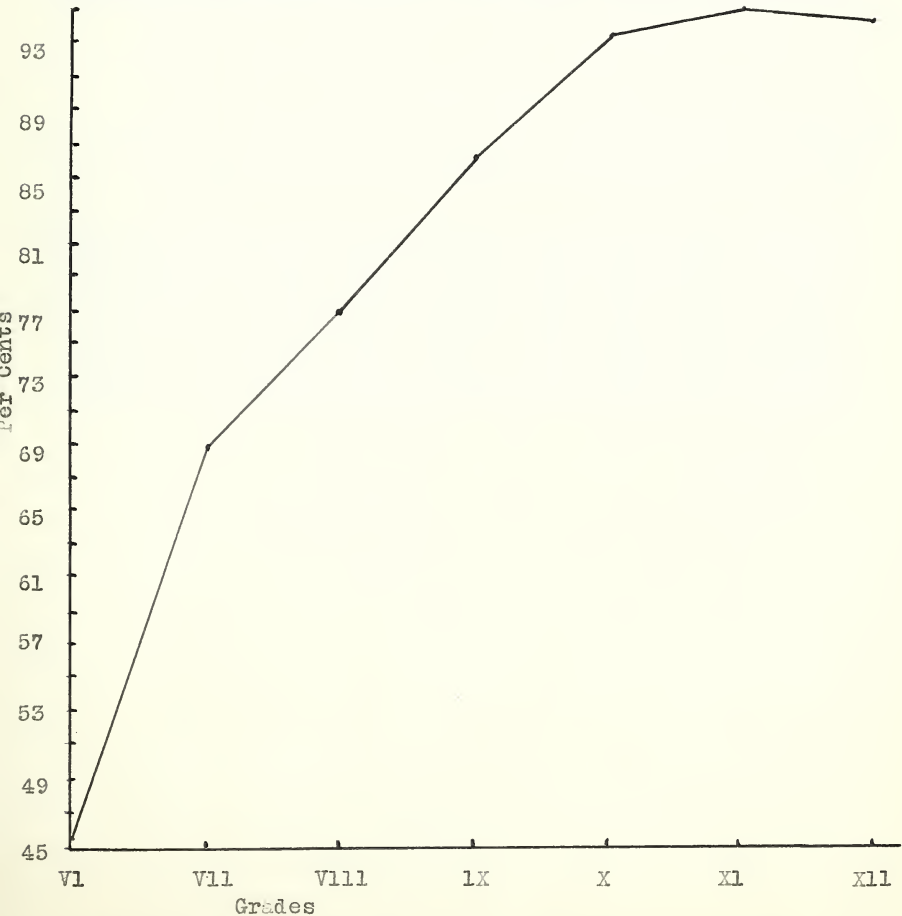
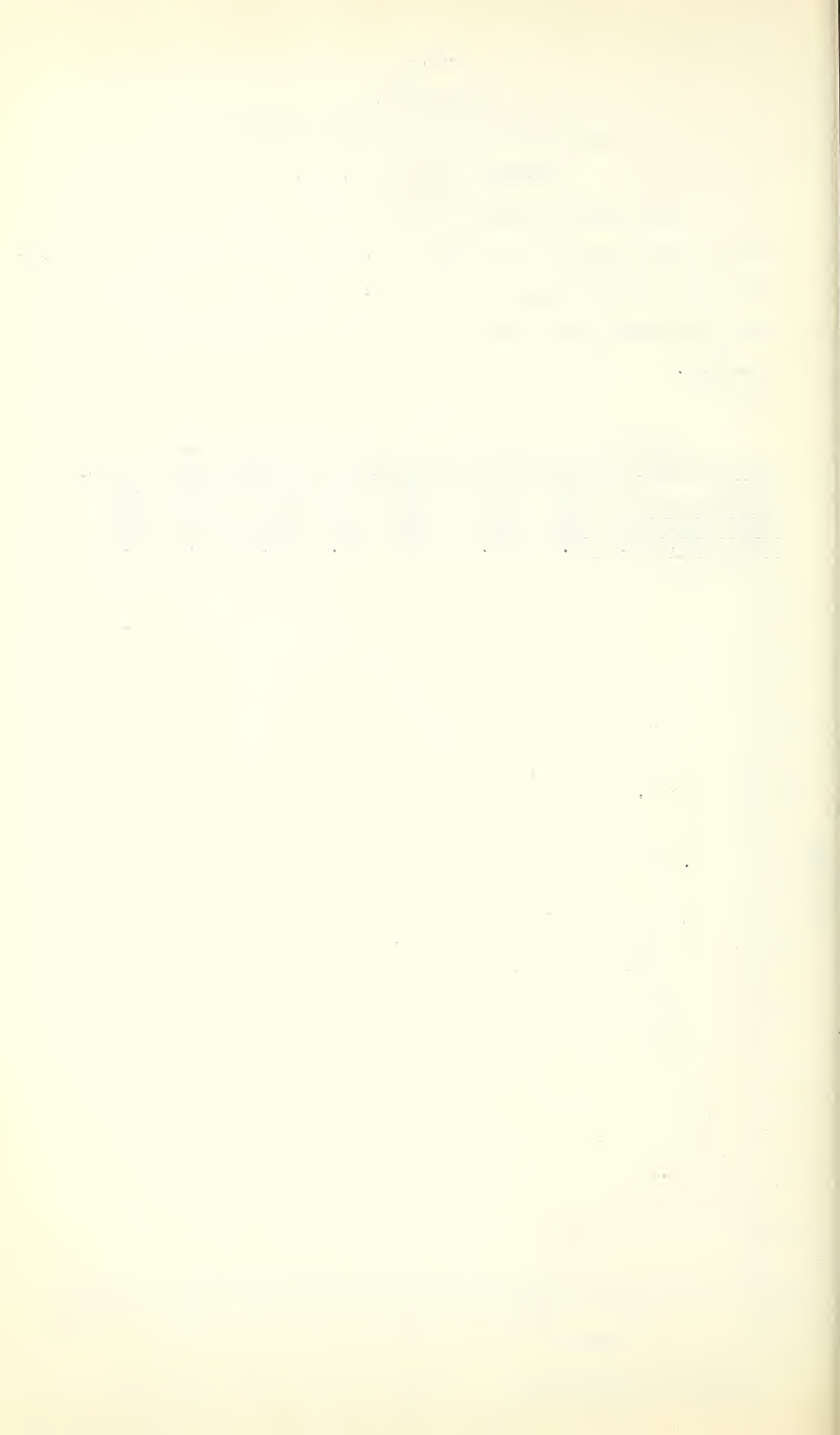


Figure 10.-Percentage of students in each grade who were able to use the words correctly in sentences.





The graph shows a marked increase from grade VI to grade VII, then a somewhat less but uniform increase from grade VII to grade X, a slight increase from grade X to grade XI and then a very small drop from Grade XI to grade XII. There is obvious improvement in ability to use the words and in the higher grades practically all students are able to use the words correctly.

### Definitions

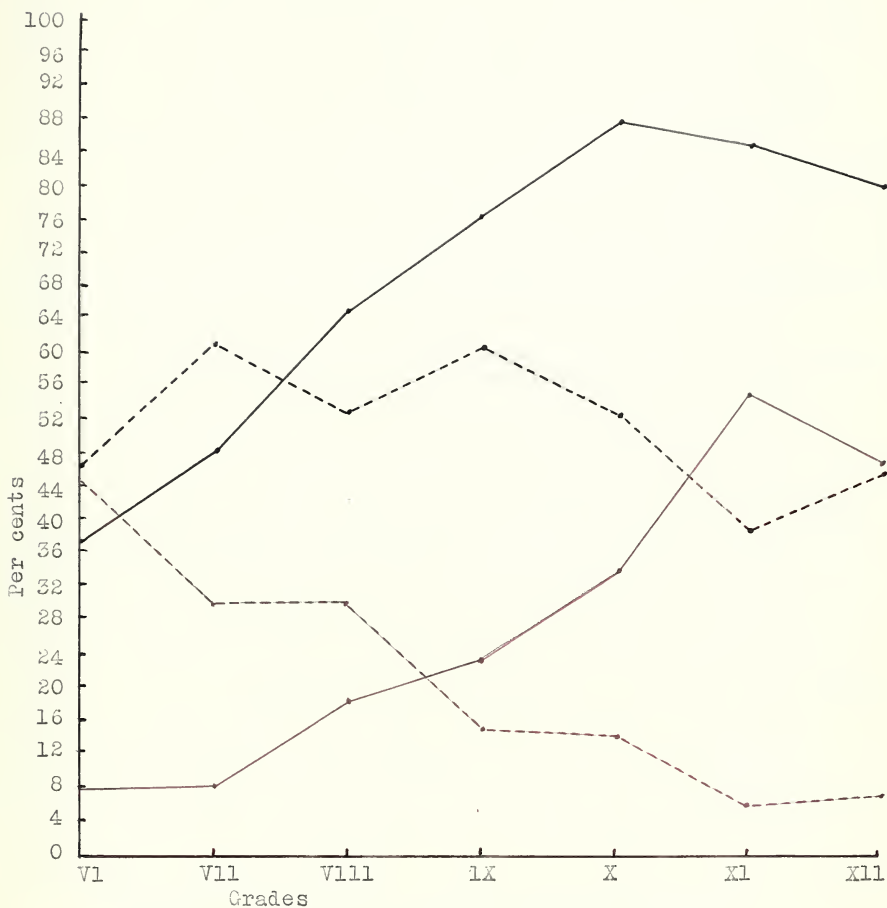
The third question on every test called for as complete a definition of the word as the student could give. The per cent of correct definitions was recorded for each grade and correct definitions were further classified as good, fair, and weak. The table and graph showing the results of this analysis are given here.

TABLE XII

PERCENTAGE OF STUDENTS IN EACH GRADE WHO GAVE CORRECT DEFINITIONS AND PERCENTAGE OF CORRECT DEFINITIONS WHICH WERE GOOD, FAIR, AND WEAK.

Grade	VI	VII	VIII	IX	X	XI	XII
Possible Def's.	342	389	231	256	125	165	216
No. Correct	127	187	150	196	110	141	176
% Correct	37.1	48.1	64.9	76.6	88	85.5	81.5
% Good	7.9	8	18	23.5	33.6	55.3	47.2
% Fair	47.2	61.5	52.7	61.2	52.7	39.0	46.0
% Weak	44.1	30.5	30.0	15.3	14.5	5.7	7.4





Solid red line--Per cent of correct definitions which were good.

Broken red line--Per cent of correct definitions which were weak.

Solid black line--Per cent of all definitions which were correct.

Broken black line--Per cent of correct definitions which were fair.

Figure 11.--Percentage of students in each grade who gave correct definitions and percentage of correct definitions which were good, fair and weak.



Ability to define the words correctly increases steadily to grade X where a peak is reached. Grades XI and XII fall back slightly. Ability to give a good definition rises in agreement with ability to define. However, the peak here is in grade XI. The number of weak definitions decreases fairly uniformly. Majority of correct definitions are fair except in grade XI and there is only a slight tendency for fair definitions to decrease in number. This analysis shows that ability to define these words well is very low in Public School. Even in the High School grades students were under 50% in their ability to give good definitions for the words. Grade XI were highest, having approximately 47% of all definitions correct and good.

It should be noted that in defining the words the students were obliged to create their own answers. Good definitions require considerable power of abstract thinking. For this reason the scores made on this question are perhaps the best indication of increase in merit in abstract thinking. Growth in denotation is indicated by the increase in the percentage of correct definitions; whereas growth in power of abstraction is perhaps more properly linked with the increase in the percentage of correct definitions which are rated good. No doubt other questions on the tests have also measured to some extent the qualities of denotation and abstraction, yet in my opinion this question brings out these qualities more specifically.

Recognition of correct usage, correct selection  
of synonyms and a measure of connotation.

In every test a question was included in which the test word was used in a number of sentences, in some cases correctly and in some cases incorrectly. The student was asked to mark each use as being correct or incorrect. The final mean per cent score for each grade was worked out by taking the average of the mean per cent scores on the twelve words. Also on every test a question was given asking the student to select from a list of words the word nearest in meaning to the test word. The final mean per cent score was worked out in the manner just described for obtaining the



correct usage scores. In order to obtain some measure of connotation one or more questions were selected from each test which seemed to measure this quality better than other questions on the test. A separate score was obtained for connotation in the same way as for recognition of correct usage and selection of synonyms. Tables and graphs are given here. These graphs and the one showing percentage of students able to use the words correctly in a sentence are shown together for the purpose of comparison.

TABLE XIII

PERCENTAGE OF STUDENTS IN EACH GRADE WHO COULD RECOGNIZE  
CORRECT USAGE OF THE WORDS.

Grade	VI	VII	VIII	IX	X	XI	XII
Percentages	48.4	56.6	59.0	65.2	68.6	75.2	74.7

Percentages are the averages of percentages on each word since the number of correct usages of each word was not uniform throughout the test.

TABLE XIV

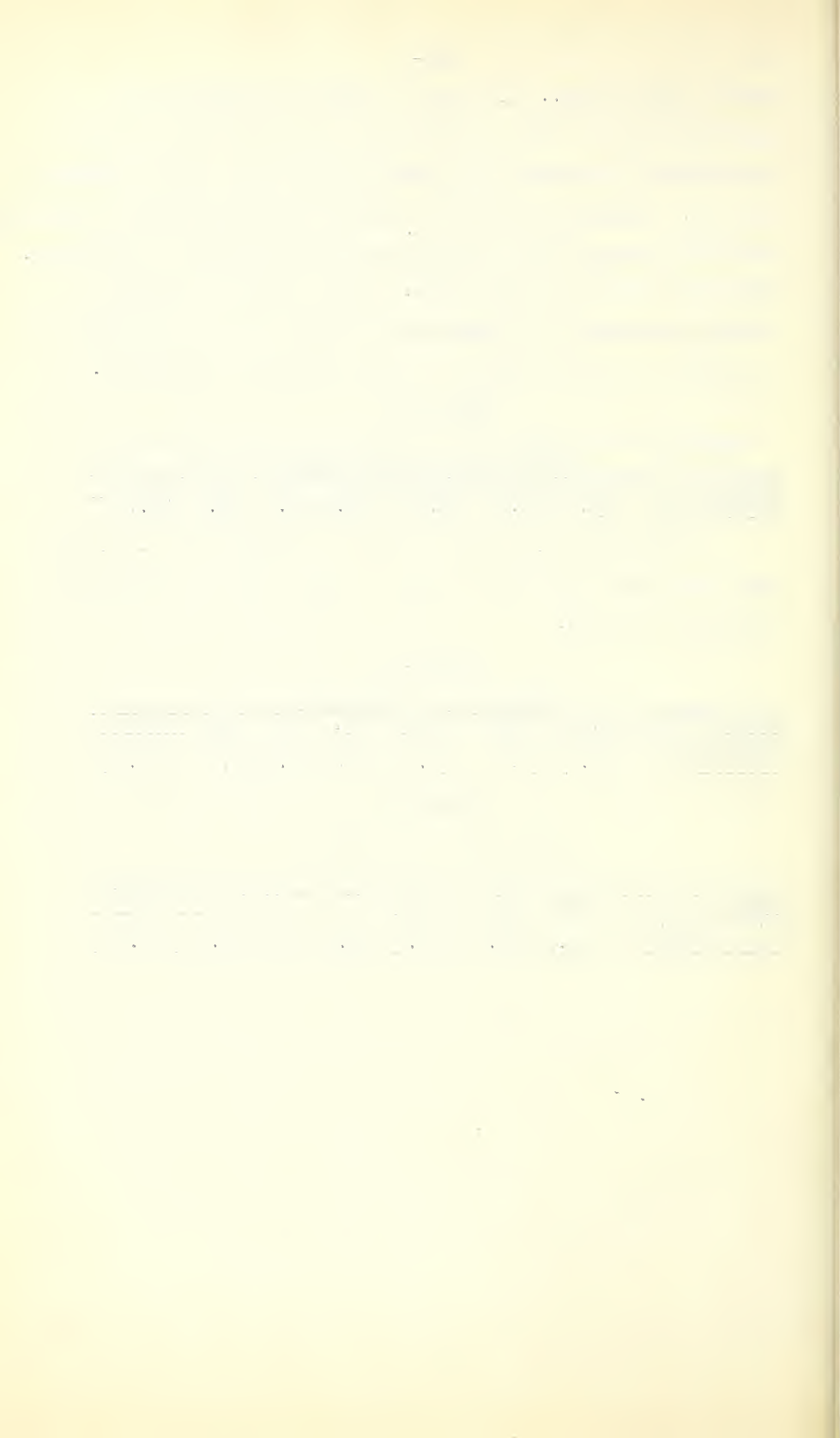
SELECTION OF SYNONYMS.

Grade	VI	VII	VIII	IX	X	XI	XII
% correctly selected	34.8	45.7	46.9	51.7	54.9	63.0	65.0

TABLE XV

A MEASURE OF CONNOTATION

Grade	VI	VII	VIII	IX	X	XI	XII
% of Possible Connotations.	49.9	59.7	58.4	63.6	70	75.8	73.5







Solid red line--Per cent ability to use words correctly.  
 Broken red line--Per cent ability to select synonyms.  
 Solid black line--A measure of connotation.  
 Broken black line--Per cent ability to recognize correct usage of the words.

Figure 12.- Showing the ability of the different grades to use the words correctly, select synonyms, recognize correct usage and showing also a measure of connotation for each grade.



It is obvious from these graphs that the ability of students to use words is greatly in excess of their ability to select synonyms, and their ability to recognize correct usage. An explanation of this might be that students gain much of their knowledge of words through using the words. The rates of increase in ability to select synonyms, to recognize correct usage, and in richness of connotation show remarkable correspondence. The almost identical behavior of the connotation and recognition of correct usage scores suggests that recognition of correct usage involves to a very great degree the connotative element. These graphs as a whole seem to indicate that increasing mastery of meanings of words is a fairly parallel advance as far as the qualities here dealt with are concerned.

## CHAPTER VI

### ESTIMATION OF MATURITY

One of the aims of this investigation was to determine growth in maturity. To do this some standard of maturity was required with which to compare the scores made by the students. A set of tests on the word "principle" was forwarded to Dr. M.E. Lazerte, director of the school of Education at the University of Alberta. Doctor Lazerte gave these tests to a senior University class of thirty-nine students. The tests were returned and scored by myself on the same basis as for the younger students. The test on the word "principle" was one of the most difficult for the students. The majority of the grades had their lowest mean score on this word. The following table gives the scores made on this word by the different grades and includes the corresponding scores made by the university class. A graph is given showing growth in knowledge from grade VI to university and the actual definitions are also included.



TABLE XVI

A COMPARISON OF SCORES ON THE WORD PRINCIPLE

Grade	VI	VII	VIII	IX	X	XI	XII	Univ.
Knowledge Scores	9.1	11.3	13.9	17.7	20.6	26.0	22.7	31.9
Error Scores	11.9	12.5	10.3	8.0	6.9	5.0	8.7	5.0
Per cent of students able to use word	0	0	0	77.3	75	90.9	68.7	90
Per cent ability to select synonyms.	25.7	36.4	41.7	46.1	40	63.1	60.9	67

TABLE XVII

KNOWLEDGE SCORES OF GRADES AS PER CENTS OF UNIVERSITY KNOWLEDGE SCORE FOR WORD "PRINCIPLE."

Grade	VI	VII	VIII	IX	X	XI	XII	Univ.
K. Score as % of Univ. score.	28.5	35.1	43.5	55.5	64.5	81.5	71.1	100

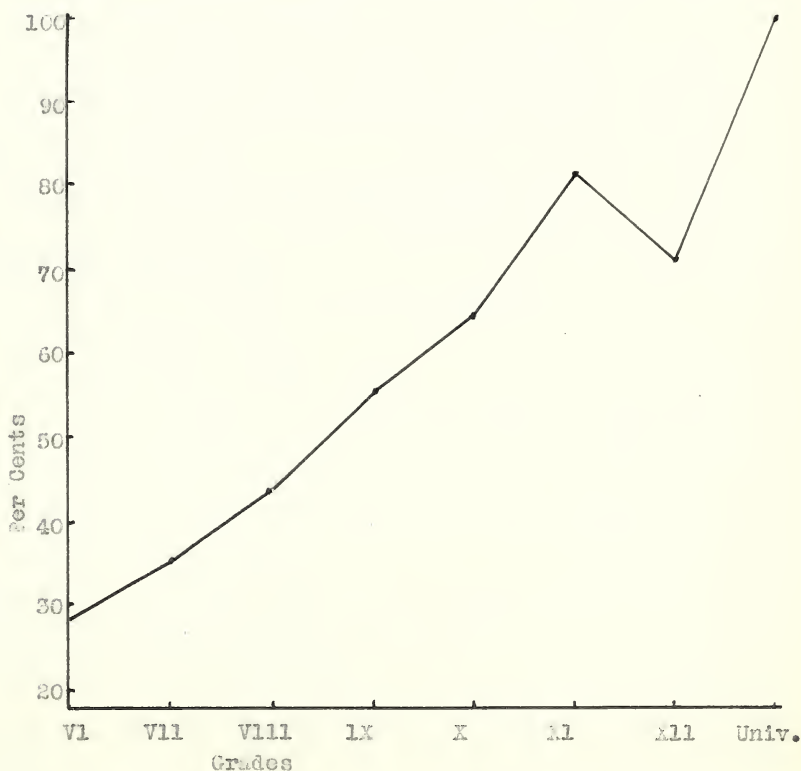
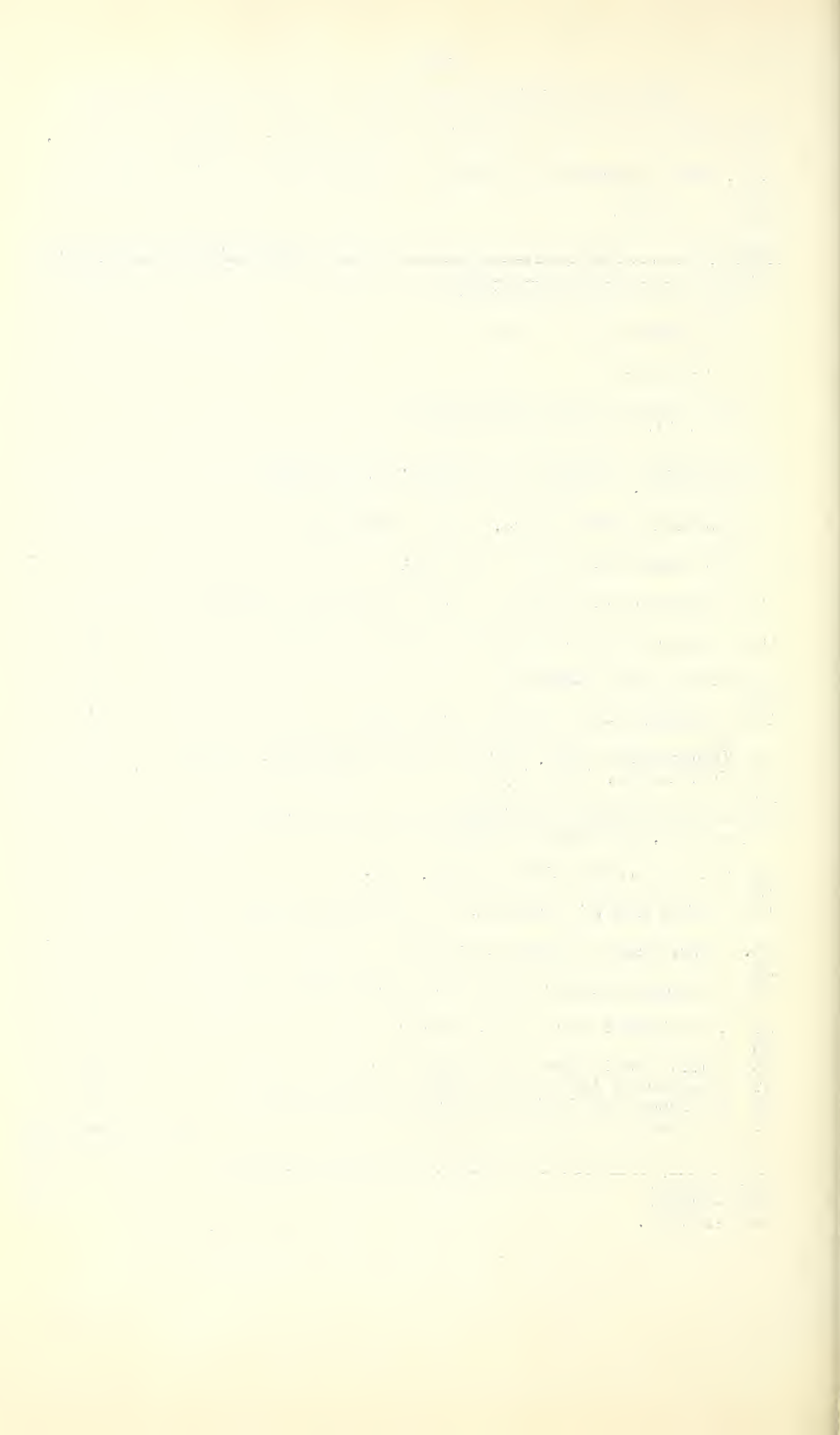


Figure 13.- Knowledge scores of the grades as per cents of the university knowledge score for the word "principle".



Actual definitions submitted for the word "principle" from grade VI to the university class follow. They are rated A, B, C, and D according to merit. Incorrect definitions are not given a rating.

Grade VI		Test word "Principle."		
No.	Definition given	R*	W*	r*
1	Head master of the school		1	
2	The main word or thing		1	
3	A beginning	1		C
4	The highest man in the school He tells the teachers what to do		1	
5				
6	The Head teacher of a school, The reputation of a person, A thing that makes things work	1	2	D
7	Knowledge and errors, also a head man		2	
8	Who tends the care of schools		1	
9	A man who takes care of the schools and pupils		1	
10	A person who looks after things in school		1	
11.	Head of all teachers		1	
12				
13	A teacher that teaches the highest grade		1	
14	Importance, main, man of great knowledge, thing formulated, truthfulness	1	3	D
15				
16	A person which is bigger than any person in school, the highest person		1	
17	One who looks after things, etc.		1	
18				
19	A high man of a school or an important man		1	
20.	A man that is high in brains		1	
21				
22	A teacher higher than those who teach lower grades		1	
24	The highest man of the school		1	
25				
26	A man who is the head person in the school		1	
27	One person head of a thing		1	
28	A person who is boss over all the teachers		1	
29	The head of all the teachers		1	
		2	26	A-0 B-0 C-1 D-2
R----right.				
W----wrong.				
r----rating.				





Grade VII		Test word "Principle."		
No.	Definition given	R	W	r
1.	The chief one <del>or</del> highest		1	
2	A head man of any place or thing		1	
3.				
4	Main ones or head people		1	
5.	The head of the school		1	
6	A head man, ones rules	1	1	D
7	Main <del>person</del> or thing		1	
8	The most important person or thing		1	
9	The head person, thing or place		1	
10	One who runs something or the head of someone. It means the main thing you ask for.		2	
11	The main thing or person		1	
12	To be the head master of		1	
13	The head person or thing		1	
14	The main thing		1	
15	The highest best subject. A person who <del>knows</del> more than others in a school		2	
16	The principle of a school		1	
17				
18	The main thing		1	
19				
20	The right or the head one		2	
21	The head man or thing of something		1	
22	The head, most important		2	
23	A principle of a school		1	
24	It is a man who looks after the children of the school to see that they do no wrong		1	
25	It means the head one or person of anything or the head building		1	
26	A chief man		1	
27	Anything private or not too good is principle Anything which is the best		2	
28	The chief things or man things or people		1	
29	Is like a head boss or undertaker		1	



Grade VII continued.		Test word "Principle." 6666		
No.	Definition given	R	W	r
30	The most important thing		1	
31	The main thing or part of something		1	
		1	33	A-0 B-0 C-0 D-1

Grade VIII

1	It means the main thing or topic		1	
2				
3	The main thing or person or place		1	
4	A fixed rule of action	1		C
5	A person at the head of something or main part		1	
6	Main, chief, the thing upon which the truth rests		1	
7	Chief, main		1	
8	The main or most important part		1	
9	The main thing or thought		1	
10	It means the most important or main thing		1	
11	A fixed rule of something	1		C
12	The foundation, beginning	2		C
13	It is the main thing of something		1	
14	A fixed rule of action	1	1	C
15	The main part of anything		1	
16	Something upon which another thing is based	1		C
17	Important		1	
18	The main or chief one		1	
19	Chief or most important, that upon which the rest are based.		1	D
		7	13	A-0 B-0 C-6 D-1

Grade IX

1				
2	It means something that helps to operate something	1		D
3	It is the main thing, the most important thing		1	
4	Main, that which makes it work	1	1	C
5	Means the way anything works, e.g. the siphon	1		B
6	The main or primary thing		1	
7	How the object is worked, what it relies on By what means it works	1		B
8	The way it works or what it relies on	1		B



Grade IX continued.

9	What it depends on to make it work	1		B
10	The main idea or what it depends on	1	1	D
11	The main one or the main thing		1	
12	It is the reason why anything that happened is made possible		1	
13	The outstanding part		1	
14	The cause of some action or the part that makes something work	1		B
15	To give the principle is to define or the reason	1		D
16	The main reasons, e.g. the principle of an air gun means the reasons which make it work	1		B
17	The main that makes a thing work	1		D
18	The main part of anything		1	
19	The primary or most important thing, or what makes a thing go or work	1	1	C
20	The main thing or what it is dependable upon	1	1	D
21	Means main also as the amount of a certain sum of money		2	
22	How the thing works or the rule	2		B
		16	11	A-0 B-7 C-2 D-5

Grade X

1	The main characteristic which something depends upon	1	1	C
2	The method used or the way run or operated, a statement	1	2	D
3	What something depends on. It is a definite method used in procuring anything. The means used	1	1	C
4	It is the thing a certain machine or any object depends on for its movement	1		B
5	Is that by which something is done	1		D
6	A person's principle is the standard they wish to live up to.	1		B
7	Is the main thing or what something depends on	1	1	D
8	The method by which something is produced or hinges on	1		C
9	Sometimes the head of a school, main most important, usually the main thread running through a story, questions answers, etc.		3	
		8	8	A-0 B-2 C-3 D-5



Grade XI		Test word "Principle."		
No.	Definitions given	R	W	r
1	Law, outstanding	1	1	C
2	The theory of anything or how and way a thing work as it does. Also the idea of the thing	2		B
3				
4	A method used in order to obtain correct results	1		B
5	A rule or law accompanying certain games, a motto or belief to follow	2		B
6	The idea, thought, action or course of something	1		D
7	The motive behind an action or idea	1		C
8	The underlying cause, rule or basic system by which things happen, occur, react, etc.	1		A
9	The underlying reason, the main point behind the working of the device, The theory that makes it work	2		A
10	The idea behind a certain thing, the indirect cause of a certain thing.	1		B
11	The main thing or rule, theory	1	1	C
		13	2	A-2 B-4 C-3

# Grade XII

1	A law, a rule laid down by discovery	2		A
2	Basis on which anything rests for its meaning	1		B
3	Law of qualities	1		D
4	The main thing		1	
5	The underlying cause. The principle of the operation of a balloon is the buoyancy of the atmosphere	1		A
6	The main idea, the important fact, ideas of what is right, a law or rule.	2	1	B
7	Main, chief, most important methods or ideas		1	
8	Main points, basic idea, outstanding mechanism or feature	1	1	C
9	Main idea or concept of the mind		1	
10	A law, an idea, a belief	1	1	C
11	The underlying idea or thought. It is that point about which something is built up	1		C
12	The most important. It may refer to character also.	1	1	D
13	The chief rule of action, that upon which something else is based.	1		B





Grade XII continued.

Test Word "Principle".

No.	Definition given	R	W	T
14	Basic fact, chief thing, motive, conception, policy, law.	3	1	B
15	Outstanding or important		1	
16	The main points or ideas, most important ideas	1	1	C
17	It may be the cause of something	1		B
		17	10	A-2 B-5 C-4 D-2

University

1	Idea or underlying factor, aim, ideal, chief, also used in reference to head of a school	2	2	B
2	Main, foremost thing of a group. Moral sense, sense of right and wrong, assumption, theory, a sum of money on which interest is received.	2	2	C
3	An underlying motive either self imposed or formulated by authority, which is meant to govern life's actions in a manner either useful or of distinct advantage to the individual. May be applied to inanimate things.	1		B
4				
5	The underlying cause or motive	1		B
6	Means or basis of action or governing our action or thought.	1		B
7	Rule of conduct or of faith or of nature or of mathematics or of science, etc. The full significance.	2		A
8	Its a derivative from Latin, First leader. Its the main idea or the underlying mechanism of a <del>problem</del> situa tion.	2		B
9	A basic or fundamental law governing the solution of a problem.	1		A
10	Fundamental truth, basic, e.g. principles of economics. Also used in sense of laws or creeds, e.g. a man's principles	2		A
11				
12	May be used as an adjective, object. It may govern the law of an act. It sets definite standards, rules.	1	1	C
13	Underlying truths which govern the actions of all matter and are foundations for man made theories	2		A
14	An underlying idea or governing concept, or something of such importance as to gain precedence.	1		B
15	Refers to the basic or underlying idea of a theme or the main point of interest, i.e., the essence of any idea, theory or concept. Synonymous with main as in main ideas also connotes scruples.	2	1	B



University		Test word "Principle."		
No.	Definitions given	R.	W	r
16	From Latin "principle", first. The outstanding entity in a series of entities. The most important entity.	1	1	C
17	The underlying law of an act or event not necessarily expressed but inherent. Primary or foremost or most important feature of a thing.	1		A
18	A fundamental quality of an action thought or material.	1		B
19	Is derived from Latin "princeps," a chief. So it means something that directs or helps to form character. A chemical or physical whole, etc. (figuratively) a building stone, an essential part of something.	2		B
20	A law, rule or statement.	1	1	B
21	Law, code, moral habits. (Moral in a broad sense) truisms.	3		A
22	A certain belief which is theoretical and which may be disobeyed without serious consequences, and which differs according to the individual.	2		C
23	Any truth which is scientifically sound, a law, as an adjective, chief or outstanding.	1	1	B
24	A lofty rule of existence	1		C
25	As a noun it means the underlying cause.	1		B
26	May refer to beliefs either moral or religious. It may be a basic law found in mechanics, nature.	2		A
27				
28	A basis underlying law or fixed belief which governs actions. As a verb--to give sound advice, to counsel fixed things.	2		A
29	Is a guiding rule or a law governing actions.	1		A
30	Noun--ideal, idea. Adverb--main	1	1	C
31	Used as an adjective means most important. Used as a noun means beliefs, laws.	1	1	C
32	Is the underlying basic factor responsible for actions, behaviours, scientific workings.	1		A
33	Is a term referring to a main point, something outstanding in the back of some theory, alluding to certain thought, ideas.	1	1	C
34	The main idea or underlying factor in a statement, object of work or act.	1		B
35	The word is an adjective used to denote a chief noun or pronoun, e.g., the main thing.		1	
36	Important concepts in a certain theory, doctrine regulating behavior either generally or in a certain field.	2		B



University continued		Test word "principle"		
No.	Definitions given	R	W	r
37	A rule not of conscious thought for guiding a person or organization or thing than its actions or decisions. It is not definite but may vary with the individual or thing.	2		B
38	Foremost, ethical component; logical ideas, logically sound practice or thought. May be made up and adhered to by the individual alone.	3	1	B
39	In banking refers to a sum of money borrowed or loaned on which interest is paid. Speaking with reference to a person the meaning of the word can be applied to the mental habits and character of the person.	1	1	B
		52	16	A-10 B-17 C-8 D-0

It is not assumed that the result of one test is reliable. Examination of table XVI shows that the trend of scores from grade VI to grade XII on this word is somewhat erratic as compared to the mean scores for all the words. The most marked differences in the scores made by the university students are in the knowledge score, which is approximately six points higher than the best score made in High School, and in the ratings for definitions. In defining the words university students display a greater wealth of knowledge and a greater power to abstract. The zero scores made by grades VI, VII and VIII students on the question calling for a correct usage of the word and in the question calling for a definition of the word led me to think they might have confused "principle" with "principal". To check this both these words were given to students of grades VII and VIII this term and they were asked to write out as full a definition as possible for each word. Without exception the definitions given for the word "principle" were still incorrect, ie, the students merely defined the word "principal" twice varying the wording slightly. A reading of the definitions submitted by university students shows that this error has persisted to a very marked degree.

In the preceding graph the knowledge score made by the university class, though not a perfect score, has been considered



CHAPTER VII

An attempt was made to elicit the students' knowledge of these words by another method. Each one of the twelve test words was given orally and the students were asked to write down whatever words came into their minds. The first three words they wrote were recorded and arranged alphabetically with the per cent frequency of occurrence of each word in each grade. An analysis for one of these words is given here. Examination of it suggests that this type of testing is difficult to compare with the results of our main investigation. Probably a more complete investigation by this method would shed valuable light on what I have done by another method.

Word given; Experiment	Frequency by Grades in Percentages.							
	Grade	VI	VII	VIII	IX	X	XI	XII
RESPONSES	No. of Pupils	28	27	26	17	21	9	13
acid			3.7	11.5		4.8	11.1	7.7
air			3.7	3.8				
animals				3.8				7.7
APPARATUS					29.4	9.5	44.4	23.1
articles						4.8		
attempt								7.7
Boyle					5.9			
bunsen burner					5.9			
bottles							11.1	
boys			3.7					
chemistry			7.4	7.7			44.4	38.5
chemicals			7.4	23.1	5.9	4.8	11.1	7.7
chemist			3.7	3.8		4.8	11.1	
car			3.7					
cream								
clay			3.7					
children			3.7	3.8				
classes				3.8				
conclusion					11.8			7.7
chlorine						4.8		7.7





Summary of word association tests continued.

	Grade	VI	VII	VIII	IX	X	XI	XII
Responses	No. of Pupils	28	27	26	17	21	9	13
<del>CO<sub>2</sub></del> CO <sub>2</sub>						4.8		
doctors	3.6							
dog			3.7					
directions					11.8			7.7
<del>drugs</del> drugs						4.8		
diagrams							11.1	
danger							11.1	
Examine	3.6							
Edison				3.8		4.8		
elements							11.1	
find	7.1	11.1	3.8	11.8				15.4
failure		3.7	3.8					
farms		3.7	3.8					
flasks					5.9			
gases		11.1	15.4			14.3	22.2	7.7
glass			15.4			9.5		
hydrogen							11.1	
inventions	3.6							
invent		3.7	3.8	5.9				
implements			3.8			9.5		
instruments			3.8			4.8		
ideas						4.8		
inventor							11.1	
jars					5.9			
knowledge						4.8		
look	3.6							
light		7.4						
laboratory		3.7	3.8			4.8		7.7
learn						4.8		
liquids						4.8		
make	3.6	7.4	3.8					7.7
MAN		7.4			5.9	9.5		7.7
medicines								
machine		3.7						
moon			3.8					
materials					5.9			7.7
Mr. McLean						4.8		
Mme Marie Currie								7.7
money							11.1	
molecules							11.1	
new	14.3	11.1				4.8		
oil		7.4						
oats		3.7						
operation	3.6							
oxygen		3.7					11.1	7.7
observation						4.8		
people		3.7						
plant		3.7						
pupils		3.7						
pin--prick		3.7						
problem					11.8			
procedure				5.9			11.1	
physics					5.9	23.8	11.1	7.7
principles								7.7
person						4.8		
professor						4.8		
prove						14.3		
results								



Summary of word association tests continued.

	Grade	VI	VII	VIII	IX	X	XI	XII
RESPONSES	No. of Pupils	28	27	26	17	21	9	13
radium								7.7
school			11.1					
soil			3.7					
science			3.7	7.7	47.1	4.8	11.1	15.4
sand			3.7					
sulphur			7.4					
solve								
stones			3.7					
satisfy								7.7
scientist					5.9			
stars				3.8				
try		50	18.5	15.4		4.8		30.8
teachers			14.9					
test			3.7					
test--tubes			3.7		5.9	9.5	11.1	7.7
tubes			11.1	11.5	5.9	9.5		
things			7.4					
tools					5.9			
trap			3.7					
wheat			3.7					
work							11.1	
workers				3.8				
water				3.8	5.9	4.8		
zinc							11.1	



CRITICISMS, INTERPRETATIONS AND CONCLUSIONS.

1. The tests, in being written, were subject to certain limitations. Firstly the student's responses could not be followed up to discover the breadth and depth of knowledge he possessed on the point in question. Secondly, the effects of guessing could not be eliminated. Thirdly, the test was partly a test of reading and ability to make written answers.
2. Although it was difficult to separate such qualities as denotation, connotation, and power of abstraction, yet we think it is possible to extract from the tests certain measures of these qualities.
3. Certain questions such as calling for other forms of the word were found to elicit little information of value.
4. Some of the questions were not sufficiently apt in that they did not bring out the wanted knowledge.
5. Certain questions tended to be ambiguous in that in spite of careful forethought some unexpected responses were given and these were difficult to score.
6. We sought to avoid bias by collaborating in the construction of the tests and in consideration of possible responses.
7. A reference to the tables showing numbers of students discloses that the sampling varied as between groups and was possibly too small.
8. There is a likelihood that the different meanings, uses, connotations, etc. did not receive emphasis proportionate to their importance.
9. The tests were uniform for all students.
10. Tests were deliberately made sufficiently easy to bring out any knowledge possessed and sufficiently difficult and comprehensive to call forth the fullest knowledge of even the best students.



11. Evidence that the tests were sufficiently comprehensive was found in that students seldom gave information beyond that specifically called for when asked to do so in the final question. Oral questioning after the tests were written revealed a similar result.
12. We feel that the remarkable correspondence in the results of the two sets of tests, as previously noted, is evidence that these tests though not standardized, possess considerable reliability.

#### INTERPRETATION OF RESULTS.

Certain local conditions such as small number of students tested, predominance of foreign language influence especially in the lower grades and the possible effect of local teaching may have given a bias to the results of these tests. Although the tests have tested directly only twelve words, yet indirectly they have tested a considerable range of vocabulary. The tests were not completely objective since the subjective element may have influenced the scoring of the definitions, etc.

#### GENERAL CONCLUSIONS

1. Knowledge of the words tested increase by grades, mental age, and chronological age. Judging from the results, knowledge of words proceeds most in accord with mental age, next by grades and least by chronological age.
2. Error decreases in the same order that knowledge increases.
3. From a comparison of the results of the two investigations, there seems to be less error associated with science words than with history words even though the lower groups begin with approximately the same amount of knowledge.
4. It is likely that growth of knowledge and decrease of error are more pronounced at certain periods. Possible plateaus may occur at senior Public and Senior High School levels.
5. Knowledge of words is more extensive and more accurate in later years of adolescence.





6. Ability to use words is in advance of ability to recognize correct usage, to select synonyms and to define words.
7. Erroneous concepts associated with words are considerable and have a tendency to persist.
8. Teaching of history especially and of science to a lesser degree has apparently failed to sufficiently clarify for the students the meanings of the words employed in the respective subjects.
9. The tests suggest the possibility of constructing a normal curve of growth of knowledge of words for all school grades.









